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Rationality vs Reality: The Dissonance between Economic Models and Experimental Data

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Abstract

Rationality was not embedded in economic theory from its onset. In fact, the discipline started with a more holistic approach to human nature, incorporating notions of empathy and altruism. It was not until economics progressed and became more concerned with mathematical models and abstract theories that rationality entered the fray. Game theory, developed in the 1940s, established several axioms about human behavior that presented people as perfectly rational economic agents. It was not until behavioral researchers started investigating the question of rationality that the economic worldview was critically challenged. This research was the driving force in the development of behavioral economics. In particular, ultimatum game experiments demonstrate systematic deviations from rational decision-making. As more and more research has emerged documenting how observed human behavior challenges the predictions of neoclassical economic theory, mainstream economics has begun incorporating these ideas. The discipline has refined existing models while also developing new ones that go back to the roots of the field. Economic agents are no longer concerned only with themselves, but also with the welfare of others. After a substantial narrowing of scope, economics is broadening its view in conjunction with psychological theories.

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Introduction

Defining the field of economics can prove deceptively difficult because even introductory texts differ in how they explain the discipline. Mankiw, a renowned economics professor at Harvard University defines economics as "the study of how society manages its scarce resources"(2014, p. 4).[1] This view has a wide scope which could partially be explained by the fact that the quote comes from a macroeconomics textbook, but it still fails to encompass all the components of economic theory. On the other end of the spectrum is a quote from Krugman, a professor at Princeton University and frequent contributor to the *New York Times*, who claims that economics is the "study of those phenomena that can be understood as emerging from the interactions among intelligent, self-interested individuals" (1999, p. 17).[2] Here the definition focuses on the individual as an economic agent and the role each person plays in the aggregate. Krugman's emphasis on the individual is an important distinction because it implies that human behavior is a necessary component to studying economics. By underlining the importance of human behavior, he demonstrates that psychology has a place in economics. A simplified version of Krugman's definition would say economics is the study of human behavior in a marketplace. However, he diminishes the power of his argument by stating that individuals are self-interested. Either the quote is too limiting, claiming that economics can only study (or account for) the actions of self-interested people, or it assumes that everyone is self-interested.

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[1] Mankiw, N. G. (2014). *Principles of Macroeconomics* (p. 4). Cengage Learning.
[2] Krugman, P. (1999). What economists can learn from evolutionary theorists - and vice versa., 17-29. Retrieved from http://www.econis.eu/PPNSET?PPN=322019508

The term "self-interest" has its economic roots in the writings of Adam Smith who is considered to be the founding father of economics. Writing in the late 18th century, Smith mentions that people act according to their self-interest. However, he did not mean to say that people are notoriously selfish. The two terms should not be considered synonymous, yet colloquially they are considered interchangeable. Smith is often taken out of context when economists quote his work. The emergence of self-interest, and later rationality, can be traced through the history of economic thought. As economics progressed, Smith's views were distorted, and ultimately their true essence was lost to most.

Smith held a holistic view of economics, incorporating ideas of individual behavior, social pressures, justice, and government into his works. He was writing at a time when economics was not even an established discipline yet- the field was still intertwined with political science and thus called political economy. The overarching trajectory of economics outlines a narrowing of scope. The field did not maintain the macroscopic view akin to Smith's for long. In addition, as the perspective of economics narrowed, it also moved into the abstract realm. This is the natural tendency for a new and blossoming discipline; however, the theory began to incorporate too many assumptions. The power of this phenomenon is seen in Krugman's definition when he writes that economics arises from "self-interested individuals." According to economists, questions of morality and human behavior were addressed using mathematical equations. Yet, these formulae proved to be too reductionist in their applications. In other words, the models became abstract and theoretical and, in turn, lost their predictive powers.

The emphasis on perfectly rational economic agents did not go unchallenged for long. Research in the 1970s, primarily in psychology, led to the emergence of behavioral economics. This relatively young field looks at economics from a psychological lens and attempts to explain the observed departures from rationality in various studies. Dan Ariely, a prominent psychologist and behavioral economist at Duke University, explains that behavioral economics flips neoclassical economic thinking on its head. The discipline extracts a theory of behavior after interpreting experimental results rather than hypothesizing behavior based on theoretical models (2010).[3] Moreover, he argues that despite many behaviors being classified as irrational, at least in an economic sense, they can still be modeled since they are systematic and predictable deviations from rationality.

The rise of behavioral economics was not a straightforward path. Initially, economists treated the experimental findings as mere anomalies; the market would be able to compensate for these errors of rationality in the aggregate. However, as Ariely pointed out, many of the behaviors are universal and consistently irrational so they will not disappear, even if analyzing the market on a macroscopic scale. It was not until the late 1990s that models of social preferences began to receive attention in economic literature. Researchers were beginning to move away from the notion that economic actors only acted to maximize their own welfare; individuals also care about the benefits to society and others.

As research in behavioral economics started to gain traction and recognition in the scholarly community, experiments focused on particular demographics and their patterns of behavior. One of the most interesting discrepancies demonstrates statistically significant

[3]Ariely, D. (2010). Three Questions On Behavioral Economics. Retrieved from http://danariely.com/2010/07/10/three-questions-on-behavioral-economics

differences in behavior between economics majors and non-majors. For instance, economics students tend to be less generous in some experimental tasks, they downplay the role of fairness in decision making, and they deviate from socially optimal outcomes. In fact, the economists' judgments and decisions in these experiments were closer to the predicted outcomes of economic models; they were acting more "rationally." At first glance, this finding seems rather obvious and trivial. The individuals studying economics were more likely to select the economically correct choice or response. On the other hand, the trend is worrying because it suggests that traditional economic models can only accurately predict behavior of those who have studied economics, or in general, more "rationally" inclined individuals and fails to account for the rest of the population.

This circles back to Krugman's definition of economics. Does he mean that the discipline can only predict behavior of self-interested individuals, or does he presume that all people are self-interested? The latter assumption has been refuted by behavioral economics: not everyone is self-interested and individuals do not always act in a self-interested manner. Furthermore, the demographic data support the hypothesis that economics predicts behaviors given that the agent is a rational decision-maker.

My thesis traces the emergence of self-interest and rationality as two major buzzwords in economics. Economics began with a holistic view of society and considered the whole person, including emotions and morality, within its scope. The stronger reliance on mathematics led to a narrowing of the discipline by reducing much of human behavior to equations. Fortunately, with the recent development in behavioral economics, and even fields like neuroeconomics, economics as a whole is broadening its perspective again. Human behavior is more complex than

neoclassical models suggest. Furthermore, I investigate whether the difference in behavior between economics majors and other students can be explained by learning and education or through a self-selection process. In other words, do individuals learn to be more "rational" thanks to the economics courses in their college career or are they already inclined to process information in a more "rational" manner? I argue that in order for economics to progress and develop stronger models, it must accommodate the psychological and behavioral economic research findings more readily.

Chapter One: Tracing the Progression of Economics

The popular image of economics has become associated with business and the world of finance but the discipline encompasses much more than that. When thinking about economics, notions like greed and selfishness emerge quite readily. Despite economics dealing primarily with human action, much of the research and theory surrounding contemporary economics has overlooked psychology. Interestingly, economics was not always such a narrow field. Adam Smith, the first "modern" economic writer, wrote about a comprehensive social structure which incorporated concepts from psychology, political science, and philosophy before some of these disciplines even formally existed. In fact, Kenneth Boulding, an economist in the mid-20th century, points out that Smith was a professor of moral philosophy at Glasgow and the theory of economics emerged out of that discipline (1969).[4] In addition, some of the research done in the last thirty years has integrated psychological theories resulting in the emergence of behavioral economics.

Adam Smith

Adam Smith's stance on economic theory is often misconstrued because modern economics takes his words out of context. Arguably, Smith's most famous work is *The Wealth of Nations* written in 1776. However, fewer people are aware of his other writings, in particular, *The Theory of Moral Sentiments* which predates *The Wealth of Nations* by almost 20 years. In fact, Smith emphasized the importance of *The Theory of Moral Sentiments* by revising it six

[4] Boulding, K. E. (1969). Economics as a Moral Science. *The American Economic Review*, *59*(1), 1-12.

times throughout his life and even claiming that it was more crucial to read than *The Wealth of Nations* (Ross, 2010).[5] To fully comprehend Smith's perspective on economics, his two works should be read and analyzed in conjunction.

To understand *The Wealth of Nations* requires some historical context. Despite being called the founding father of economics, economic thought was alive well before Smith started writing. Even Greek philosophers such as Aristotle were writing about economic issues. Immediately before Adam Smith, the reigning economic thought was established by the mercantilists from the 16th century. Mercantilists emphasized the importance of gold and the size of the treasury. Therefore, the mercantile class encouraged exports and abhorred imports. The accumulation of wealth depended on hoarding gold by selling goods to other nations. England was not endowed with the natural resource of gold. Their only method of acquiring the precious metal, which also served as the global currency at the time, was to sell to foreign nations. Exporting had a twofold effect, such that it increased the gold in the home country's treasury and reduced the amount of gold in the foreign nation. This also explains why the mercantilists disliked imports; purchasing foreign goods reduced the domestic amount of gold.

Additionally, they argued that wages must be kept only at a subsistence level. Ironically, to maximize national income, workers' incomes were kept at a minimum. Thus, the epitome of mercantilism can be summarized by Mandeville when he writes "In a free nation… the surest wealth consists in a multitude of laborious poor" (as cited in Marx, 2007, p. 674).[6] Hence, Smith titles his second book not just *The Wealth of Nations* but *An Inquiry into the Nature and Causes of the Wealth of Nations*. Smith wrote the book as a critique of mercantilist thought and its

[5] Ross, I. S. (2010). *The Life of Adam Smith.* Oxford University Press.
[6] de Mandeville, B. (1728). *The Fable of the Bees*. London. In Marx, K. (2007). *Capital: A Critique Of Political Economy - The Process Of Capitalist Production.* Cosimo.

restrictions on trade, arguing that the wealth of a nation is determined not by its vast treasury, but by its labor force and its ability to produce and consume. It is not sufficient to merely measure the labor force but also its production levels and the amount of consumption per capita in the market.

Simply looking at the titles of Smith's books offers the reader a glimpse of their main focus. *The Theory of Moral Sentiments*, from the onset, does not sound like a book on economics. Though the work is predominantly filled with philosophical discourse, Smith uses it as a foundation for *The Wealth of Nations*. *The Theory of Moral Sentiments* deals with human nature and behavior in the marketplace, laying down the general groundwork, whereas the "sequel" concentrates on details.

Before commencing the breakdown of *The Wealth of Nations*, it is imperative to first put into context Smith's magnum opus, *The Theory of Moral Sentiments.* Smith begins the book by stating, "How selfish soever man may be supposed, there are evidently some principles in his nature, which interest him in the fortune of others, and render their happiness necessary to him, though he derives nothing from it except the pleasure of seeing it" (2010, p.7).[7] Smith immediately claims that people have an intrinsically altruistic tendency. Despite appearing selfish, men still care for their neighbors because seeing others' pleasure brings them personal pleasure. He describes how empathy drives the need to help others. Incorporating such rhetoric seems counterintuitive to the rational agent model now commonplace in modern economics. Economic agents are thought to be devoid of emotion, acting only in their self-interest. However, this misconception comes from economists' misconstrued notions of Smith.

[7] Smith, A. (2010). *The Theory of Moral Sentiments* (p. 7). Penguin.

When asserting that individuals act in their own self-interest, Smith did not imply that people do not care for others. Self-interest is not a synonym for selfishness. In fact, Smith highlighted the significance of cooperation within a society. Specialization and division of labor cannot be sustained outside a collaborative community. One of Smith's most famous quotes is regularly misinterpreted. He writes, "It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own self-interest" (2007, p. 15).[8] From this statement, readers gather that the laborers work not for the welfare of society, but because of their egocentrism. However, that does not seem like the logical conclusion. The baker cannot disassociate himself from the community since his responsibilities consist of only baking bread. How can he receive the clothes on his back, the wood in his stove, and the roof over his head? Other contributing members of society provide those resources. It is thus in the baker's self-interest to bake because otherwise, he would have nothing to contribute to the market and therefore have no money to procure those other goods.

The misinterpretation of Smith's parable could be mitigated by simply reading the sentence following the previous quote: "We address ourselves not to their humanity but to their self-love, and never talk to them of our own necessities, but of their advantages" (2007, p. 15).[9] The focal point of *The Wealth of Nations* posits that specialization of labor is the most efficient use of resources in the economy. For instance, the bakers bake and sell their wares to buy vegetables from the farmers and fish from the fishermen. Smith insists on the natural human tendency to barter and exchange goods and services. He clarifies in the above quote that although people are altruistic we cannot rely on infinite charity. This corresponds to a term now known as

[8] Smith, A. (2005). *Wealth of Nations* (p. 15). JSTOR.
[9] Smith. WN. (2005) p. 15

donor fatigue- individuals will not continue giving generous contributions without further incentives. Therefore, Smith asserts that we capitalize on everyone's advantages and specialize in whichever skill we perform best.

This model demonstrates interdependence rather than underscoring independence and egocentrism. Already, there is a drastic departure from the mercantilist ideology. Smith does not mention "the laborious poor." Instead, he insists that workers are the source of wealth in an economy; increasing their productivity will increase the income and, in turn, the welfare of the nation. The economy does not grow at the expense of the poor, it grows with them, because of them. In fact, Smith begins *The Wealth of Nations* by writing, "The annual labour of every nation is the fund which originally supplies it with all the necessaries and conveniences of life which it annually consumes, and which consist always either in the immediate produce of that labour, or in what is purchased with that produce from other nations" (2005, p. 1).[10] Similarly to the first lines of *The Theory of Moral Sentiments*, Smith indicates the main purpose of his book without delay. His aim to refute the mercantilist point of view is clear. As mentioned earlier, Smith wants to make clear we measure the value of an economy through the "necessaries and conveniences" produced by the labor force or via imports, not just by the labor force itself.

Thus far, Smith appears idealistic and slightly unrealistic in his description of the world. There are obviously instances of greed, selfishness, and disregard for others present in society. He addresses these vices and shortfalls of human nature as well, incorporating the complexity of human behavior and reasoning into both his books. His major criticism of the human experience is that an individual's incentive to become rich often overwhelms the mind and downplays the

[10] Smith. WN. (2005) p. 1

incentive to do good. “The rich man glories in his riches,” he writes, “because he feels that they naturally draw upon him the attention of the world” (2010, p.50).[11] People strive for fame and fortune, and if they achieve it, they feel compelled to flaunt it to the world. Therefore, Smith concludes, the end goal of acquiring wealth is not the fortune itself, because there can always be more assets in the bank. Rather, “it is the vanity [of being wealthy], not the ease, or the pleasure, which interests us” (2010, p.50).[12] In other words, Smith argues that human nature moves us to seek the affirmation of others. The rich want to be recognized whereas the poor want to stay out of the spotlight. He goes on to state that “wealth and greatness are mere trinkets of frivolous utility,”(2010, p.181) again undermining the strong urge to pursue wealth at all costs.[13]

Perhaps the strongest evidence for Smith’s criticism of the pursuit of wealth comes from his parable about the poor man’s son. In the story, the son aspires to greatness and believes that becoming rich will let him achieve that goal. He toils day and night for years, working several jobs with little rest. The son earns his money and increases his fortune but at an extreme cost. At a relatively young age, he is worn out and feeble. Despite being rich, he is still discontented with his life. Lying on his deathbed, the poor man’s son realizes that he has wasted away his youth on amassing wealth which, in the end, is devoid of significant meaning. Smith asserts that this misguided drive to pursue riches stems from the spectator- the inner voice inside a person’s mind that can be equated with consciousness of the self. Furthermore, Smith claims that, “He [the spectator] does not even imagine that they are really happier than other people; but he imagines that they possess more means of happiness” (2010, p.182).[14] Now Smith is connecting the

[11] Smith. TMS. (2010) p. 50
[12] Smith. TMS. (2010) p. 50
[13] Smith. TMS. (2010) p. 181
[14] Smith. TMS. (2010) p. 182

ambition for material wealth to the concept of happiness. Namely, he denies the adage "money can buy happiness." Money can buy goods and services that evoke happiness, but wealth itself does not increase happiness. For Smith, becoming rich is not the point of working arduously. Though ambition and competition are important to him, they should not supersede compassion for others and one's self. Additionally, it is important to note that Smith describes the poor man's journey as one of "unrelenting industry" as he strives to "acquire talents superior to all his competitors" (2010, p.181).[15] Thus, Smith insists that competition and labor are the means by which to gain wealth. It is not at the expense of others, as mercantilists may have suggested, but through perspiration and determination. The young man struggles but rightfully earns his money by his own merit.

This theme of critiquing the pursuit of wealth is found throughout *The Theory of Moral Sentiments*. Smith writes, "the candidates for fortune too frequently abandon the paths of virtue" (2010, p.64).[16] The philosophical side of Smith emerges again as he speaks about virtue and moral character. These ideas are not typically associated with Smith's teachings, yet they are a prominent feature in his writings. His comprehensive economic structure incorporated the essential human notions of morality and virtue. Moreover, Smith states that "In the race for wealth, and honors, and preferments, he may run as hard as he can, and strain every nerve and every muscle, in order to outstrip all his competitors. But if he should justle, or throw down any of them, the indulgence of the spectators is entirely at an end. It is a violation of fair play, which they cannot admit of" (2010, p.83).[17] Smith stands by his view that every society requires an established system of justice and a respect for it. People must uphold a certain moral code in

[15] Smith. TMS. (2010) p. 181
[16] Smith. TMS. (2010) p. 64
[17] Smith. TMS. (2010) p. 83

order for the society to function properly. Hard work should be appreciated and those who cheat or exploit others will be scorned and punished justly. Otherwise, without appropriate repercussions, the race to wealth will tempt people to abandon paths of virtue and result in a corrupted community.

This overview of Smith challenges the short excerpts most people read in introductory economics textbooks. Though *The Wealth of Nations* was revolutionary in its time by redefining how markets and economies grow, it did not provide a full picture of what Smith had in mind. It is important to remember that Smith wished for people to read both his works together for a complete understanding of the markets and political economy.

Ashraf, Camerer, and Loewenstein (2005) voice even stronger opinions on Smith's two books in asserting that Smith can actually be considered to be a behavioral economist by today's standards.[18] He combined economics and psychology into a complete framework, even before modern psychology, or economics for that matter, had emerged. Some of Smith's insights have actually been verified by recent experimental research. For instance, in *The Theory of Moral Sentiments,* Smith writes, "Pain...is, in almost all cases, a more pungent sensation than the opposite and correspondent pleasure" (2010, p.176).[19] This concept, coined by Kahneman and Tversky in 1979, is loss aversion. People are hurt more by a loss than by a corresponding gain; a utility curve is not mirrored across the axis. Smith wrote about this phenomenon in the 18th century, yet it only became a revolutionary idea in economics when Kahneman and Tversky "discovered" the effect using experimental methods.

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[18] Ashraf, N., Camerer, C. F., & Loewenstein, G. (2005). Adam Smith, Behavioral Economist. *The Journal of Economic Perspectives*, *19*(3), 131-145.
[19] Smith. TMS. (2010) p. 176

Smith touches on aspects of human nature and altruism that quickly get lost in the study of economics. By adding a time dimension to decision making, people are torn between two choices- an immediate but minor pleasure, or a much greater one but far in the future. Smith refers to this dilemma as another example of the struggle between passions and the impartial spectator (2010).[20] The impartial spectator can weigh the increased benefits of waiting, but passions are myopic and seek immediate gratification. This is akin to the concept of a dual process model in behavioral economics; Thaler and Shefrin (1981)[21] call it the fight between a doer and a planner, whereas Laibson (1997)[22] refers to the phenomenon as a "quasi-hyperbolic discounting model." Recent research has gone so far as to conduct brain scans involving such decisions, and the data indicate that different regions of the cortex are activated depending on the timeframe of the choice (McClure et al., 2004).[23]

Smith may have incorporated moral philosophy into his writings on economics, but the discipline did not head in that direction. Future writers relate back to Smith, acknowledging his eminent presence in economics; however, they fail to to include a comprehensive overview of the field like Smith. Surely they allude to human nature, but they do not have the same grasp of behavior and emotion that Smith referenced in his works. It is not difficult to imagine why current economists have a narrow understanding of Smith if even one generation down his *Theory of Moral Sentiments* was overlooked.

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[20] Smith. TMS. (2010) p. 272

[21] Thaler, R. H., & Shefrin, H. M. (1981). An Economic Theory Of Self-control. *The Journal of Political Economy*, 392-406.

[22] Laibson, D. (1997). Golden Eggs And Hyperbolic Discounting. *The Quarterly Journal of Economics*, 443-477.

[23] McClure, S. M., Laibson, D. I., Loewenstein, G., & Cohen, J. D. (2004). Separate Neural Systems Value Immediate And Delayed Monetary Rewards. *Science*, *306*(5695), 503-507.

David Ricardo

The prominent writer on political economy after Smith was David Ricardo. Ricardo was an English economist and member of Parliament who became involved with economic theory after reading Smith. Many of his writings deal with the contemporary issues facing the English economy such as the tariffs on corn, and the depreciation of bank notes.[24] His most noteworthy book, however, is *The Principles of Political Economy and Taxation.* Written in 1817, the text attempts to explain the appropriate price for labor and how income is distributed. Furthermore, the book presents economics in a narrower light than Smith, excluding much of the philosophy and quasi-psychology found in *The Theory of Moral Sentiments.*

The major question on the minds of economists at the time was the valuation of commodities and labor. Ricardo begins *The Principles of Political Economy and Taxation* by explaining how goods get their value and then connects that idea to the theory of wages. He writes, "Commodities derive their exchangeable value from two sources: from their scarcity, and from the quantity of labor required to obtain them" (Ricardo, 1891, p. 8).[25] The latter part of the statement affirms what Smith posited in *The Wealth of Nations*- the cost of production determines the value of a good. Ricardo further expands this claim by including costs of creating the capital to then produce a final good and the associated upstream costs. It should be noted that both Smith and Ricardo so far have concentrated on the supply side of economics. They focus on

[24] Ricardo, D. (1811). *The High Price of Bullion: A Proof of the Depreciation of Bank Notes* (Vol. 19, No. 1). John Murray, 32, Fleet-Street; Ricardo, D. (1815). *An Essay on the Influence of a Low Price of Corn on the Profits of Stock* (Vol. 4, pp. 1-41). J. Murray.
[25] Ricardo, D. (1891). *Principles of Political Economy and Taxation* (p. 8). G. Bell and Sons.

scarcity and costs as the determinants of value, rather than individual preferences. Demand side economics does not emerge for a few more decades.

Ricardo diverges from Smith's inclusion of morality and virtue when it comes to his subsistence theory of wages, which later came to be known as the Iron Law of Wages. Whereas Smith argues that in the short run wages will rise due to the goodwill of the people, leading to higher production and more loyal workers, Ricardo holds a harsher view of wages in the long term. He asserts that increasing wages because of benevolence will ultimately backfire. With more disposable income, workers will be able to afford more luxuries and have the ability to raise more children. This increase in population size will translate to a larger supply of workers. According to the model, wages would subsequently decrease due to the increase in labor. So after only one generation, wages will have dropped back down. Thus, Ricardo argues, the natural price of labor is a subsistence wage. Any more than that and the influx of workers down the road will decrease wages. Moreover, Ricardo tells a macabre account of how wages will stabilize. He states that when the market price for labor is below its natural price, laborers will live in poverty. The only way to resolve the situation is for the labor force to decrease, which has to happen given that people will be working for less than a subsistence level, or the demand for labor has to increase.[26] This dark view is a stark departure from Smith's writings on goodwill and a morally just society. Although Ricardo's writings do not indicate the emergence of the rational thinking model found in modern economics, there is already a departure from moral philosophy.

Although Ricardo developed the Iron Law of Wages, he did not believe this was the proper allocation of wealth in an economy. He claimed that distribution of income was culturally

[26] Ricardo. (1891) p. 8

dependent, a sentiment that arose from living during the feudal system. The Iron Law of Wages illustrates how wages will equilibrate to subsistence levels and landlords will collect massive amounts of money from the laborers. Ricardo was not content with the notion that the landlords amassed wealth at the expense of the farmers. Thus, he asserted that the rents received by the landowners be taxed and then redistributed to the poor. So Ricardo proposed the grim, long run equilibrium of the Iron Law of Wages but was not satisfied with its results. He was not entirely eliminating morality from his economic worldview. However, his model indicates a pivotal step in the narrowing of the field. According to Ricardo, individuals were essentially fated to follow the Iron Law of Wages and live in such a reality. It may not be a virtuous and honorable system but the laborers were subject to it due to circumstances of birth.

Another major contribution to economics is the Ricardian model of trade. Ricardo pioneered the concepts of comparative advantage which then formulated his views on trade. Looking at two nations which trade with one another, their imports and exports will depend on the relative ease of production rather than its value. For instance, even if the United States could produce both cars and corn more efficiently, it could still trade with a country that is less cost-effective in production of cars or corn. It is the relative cost of producing more cars as opposed to more corn that matters. Therefore, just like Smith, Ricardo was a proponent of free trade. He argued that trying to produce all the goods necessary for a society will spread the labor and capital of an economy too thin. Specialization is integral for an economy to grow and flourish. Thus, Ricardo illustrates the very first notions of opportunity cost in his trade model. This foreshadows the emergence of rational cost-benefit analysis. By weighing options of

comparative advantage, one can overlook moral and ethical concerns because the opportunity cost ultimately provides the solution.

John Stuart Mill

The next important figure to consider is John Stuart Mill, who wrote during the middle of the 19th century. Mill is still considered a classical economist, drawing heavily on the works of Smith and Ricardo, but he is also a link to the upcoming neoclassical movement. Mill starts off *The Political Economy* with a sentiment that closely matches Smith's. He claims that a comprehensive work on economics must include a section on morality (2009).[27] Mill expresses concern for the welfare of society and includes normative claims in his writing. For example, he promotes public education and emphasizes the importance of human capital. With a more intelligent workforce, society as a whole benefits. Even though this example may seem trivial, it demonstrates a new concern for the individual in society. So far, economists have been exploring the markets with a macroscopic lens, but Mill peers closer to claim that each individual person matters too.

Mill further developed the notions of opportunity cost and comparative advantage which started with Ricardo. Mill conjured up the notion of reciprocal demand. It showed a new aspect of trade, claiming that people in the home nation should care about the income and welfare of individuals living in foreign trading countries. Mill explains that if the origin country exports cloth to the destination country, the more income the destination country has the better. They

[27] Mill, J. S. (2009). *Principles of Political Economy* (p. 4). La Vergne: General Books LLC.

will be able to purchase more cloth and thus expand the industry at home. The reciprocal is also true; the destination country wants the origin country to have higher incomes so that they can export more to their trading partner. In other words, income is determined by the demand for the exported good, which itself is determined by the income of consumers in the destination country.

The notion of reciprocal demand adds a new dimension to economics. Society now is not only concerned with the well-being of citizens in a specific country, but with humanity on a global scale. Economic theory has evolved far from Mandeville's quote about the laborious poor.[28] Markets become more successful when people have higher incomes, which in turn stimulates consumption, and the cycle goes on.

The Marginalists

The revolutionary change in economics occurred in the late 19th century with a movement of writers called the marginalists. Ricardo's Iron Law of Wages, it turned out, did not accurately predict the growth of wages and wealth in an economy. As population increased, wages rose with it, and thus national income grew year by year. History proved Ricardo wrong, and economic thinkers began searching for new explanations regarding the distribution of wealth and the price of labor. The labor theory of value crumbled given the new data on population. The classical view that value was derived from the amount of labor required to produce a commodity no longer held. With that crucial argument now obsolete, the future generation of economists was able to form newfound conjectures regarding value and wages.

Carl Menger was one of the first marginalist economists, writing contemporaneously with William Jevons and Leon Walras in the 1870s. Menger looks at an economy from a different

[28] de Mandeville, B. (1728).

lens. He posits that the "valuing individual" is the most basic unit in a market. This focus on individual consumers leads him to ideas concerning personal preferences. Menger states that value is not intrinsic to each good, as previous economists thought (1950).[29] Rather, the value depends on the subjective preferences of each person. Preferences give rise to utility functions which map out how much benefit a person receives from consuming or purchasing a particular item. Menger arrives at the marginal utility theory as the determinant of value. The theory states that value is determined on the margin, meaning that consuming increasing quantities decreases the value. For instance, the first bottle of water consumed by a thirsty man will bring him more enjoyment and benefit than the second bottle. Consequently, the second bottle will still be more valuable than the third, and so on. Thus, value is determined at the margin, not by any intrinsic properties or costs of production.

By refuting the classical economists from the past century, Menger resolves critical issues within economics. One significant problem that the obsolete labor theory of value was unable to explain was the water-diamond paradox. Water is a resource necessary to our survival, yet it's extremely inexpensive. Diamonds, on the other hand, serve no real purpose other than to display someone's wealth. With so much demand for water, the price should be significantly higher than it is in practice. Marginal utility theory is able to reconcile the water-diamond paradox because value is not based on grand totalities. People evaluate their choices on the margin and do not take into account the entire global supply of water or diamonds. In other words, the benefit from gaining another diamond is drastically greater than the benefit of

[29] Menger, C. (2007). *Principles of Economics* (p. 120-121). Ludwig von Mises Institute.

receiving more water. With the abundance of water in society, an additional unit of it is not valued as highly.

Although Menger, Jevons, and Walras all agreed on marginal utility theory, Menger's approach caused a schism in economics. Jevons and Walras were fascinated with the application of calculus to economics. They wanted to transform the discipline and bring it closer to classification as a science. Hence, they took a more mathematical approach to marginal utility theory by graphing utility functions. Menger, on the other hand, disapproved of the progress towards a hard science. He refused to see how human beings could be reduced to mere equations. Furthermore, he argued that utility can only be used as an ordinal measure, not a cardinal one. In other words, it is possible to say that a book is valued more than a cup of coffee and create a ranking system, but it is nonsensical to state that a book is worth three times as much as coffee to a certain person. Menger rejects Jevons' concept of "utils" as measures of utility and therefore cannot graph utility functions like the other marginalists. This debate regarding the mathematical approach to economics creates a schism between the neoclassicists, like Jevons, and the Austrian School of Economics, founded by Menger.

William Jevons firmly believed in the application of mathematics to not only economics but all of behavior and human nature. In the introduction to *The Theory of Political Economy* Jevons writes, "Now there can be no doubt that pleasure, pain, labour, utility, value, wealth, money, capital, etc., are all notions admitting of quantity" (1879, p. 9).[30] He claims that all the above listed human phenomena can be reduced to a number and therefore an equation. Yet, it is difficult to grasp how emotions and experiences like pleasure or pain can be quantified. This

[30] Jevons, W. S. (1879). *The Theory of Political Economy* (p. 9).

further explains why Menger did not support the concept of "utils" as a measure of individual welfare. In this regard, Menger makes more sense when he claims that they have ordinal rankings but not cardinal ones. Furthermore, Jevons goes on to state that "the whole of our actions in industry and trade certainly depend upon comparing quantities of advantage or disadvantage" (1879, p.10).[31] This statement alludes to the rationality of the individual in the market. According to Jevons, consumers weigh a number that represents the advantage of purchasing a good against a number representing the disadvantage of such an action. Market decisions, therefore, can be explained by a mathematical quasi-cost-benefit analysis. In fact, Jevons includes mathematical calculations in his book in explaining diminishing marginal utility. He boldly asserts that "Pleasure and pain are undoubtedly the ultimate objects of the Calculus of Economics," (1879, p.29) reiterating his stance from the introduction.[32] The emphasis of calculus in economics pushes the field down the path to a greater concern and concentration on rational behavior. For the equations put forth by Jevons to work, human behavior must be logical and systematic; consumers will maximize their utilities and there is no other alternative. Thus, Strathern asserts that Jevons, along with Walras, move economics one step forward in theory, but one step back in terms of representation of reality (2001).[33]

The Neoclassical Economists

John Bates Clark, a neoclassical economist, further advanced the discipline with his theory on wealth distribution. Just as with Smith, looking at the first line of Clark's text titled *The Distribution of Wealth: A Theory of Wages, Interest, and Profits* provides insight into the

[31] Jevons (1879) p. 10
[32] Jevons (1879) p. 29
[33] Strathern, P. (2001). *Dr. Strangelove's Game: A Brief History of Economic Genius* (p.219). Hamish Hamilton.

main focus of the entire work. Clark writes, "It is the purpose of this work to show that the distribution of the income of society is controlled by a natural law, and that this law, if it worked without friction, would give to every agent of production the amount of wealth which that agent creates"(1902, p.1).[34] Clark immediately remarks that economics is governed by natural laws, drawing parallels to scientific fields. He, like other economists at the time, is trying to establish a more concrete system to understanding economics. The use of equations and graphs also simplifies the work they have to do. Clark, along with his contemporary economists, is relieved that questions of morality and ethics were finally answered by economic models. They no longer have to concern themselves with what is the right wage for a particular job. Rather, the solution is to pay people what they were worth, which is measured by their production.

As the title clearly suggests, Clark arrives at his conclusions by investigating how income is distributed in an economy. He breaks down this hierarchy of income distribution into three levels. First, the national income is divided up into various industries, be it wheat, steel, or cotton. Afterwards, the income in that particular sector is partitioned to the capitalists, the laborers, and the entrepreneurs. Lastly, there are several sub-groups in each of these categories because production is split between numerous groups.[35] For example, the income of the wheat industry has to be allocated to the farmer, the miller, the baker, and so on.

Clark claims that in equilibrium "prices are at their natural level when labor and capital in one industry produce as much and get as much as they do in any other" (1902, p.19).[36] In this case, laborers will have no incentive to move from one industry to another. Therefore, natural prices cannot be determined by looking only at one industry. The whole economy must be in an

[34] Clark, J. B. (1902). *The Distribution of Wealth: A Theory of Wages, Interest and Profit* (p. 1). Macmillan.
[35] Clark (1902) p. 17
[36] Clark (1902) p. 19

equalized state for Clark's claim to be true. This perspective on the equilibrium condition of the economy shapes Clark's theory of wages. He writes "the specific productivity of labor fixes wages" (1902, p.35) meaning that wages are determined by the value of the product.[37] In essence, Clark posits that laborers are paid what they are worth, and they are worth what they produce.

The transition to neoclassical economics can mainly be attributed to Alfred Marshall, the economist who was able to reconcile both demand and supply side economics. Marshall became fascinated by economics after reading Mill's work which emphasized the role of morality in economics. Marshall's drive included combatting poverty using sophisticated economic modelling. Strathern remarks that Marshall had two conflicting forces in his life- the first being his passion for mathematics and the second an extremely positive view of Christian virtues except for faith itself.[38] Writing in the 1890s, he combined demand and supply side economics by claiming that price is determined by the intersection of a demand and supply curve. Both were required to derive the price of a good. Furthermore, Marshall introduced the idea of partial equilibrium analysis. This method allowed for economists to investigate issues on a wide range of scales, from analyzing an entire country to just one industry and even a single individual in the market.

Marshall was revolutionary in that he was able to apply his theories broadly in economics theory. However, his partial equilibrium analysis posed a problem. In fact, it was a critical issue that was starting to puzzle many economists at the time. As the discipline grew and became more understandable, more variables were used to explain economic phenomena. There was more to

[37] Clark (1902) p. 35
[38] Strathern. (2001) p. 222

the market than just price, wages, and rent. Now the field had to tackle marginal product, marginal utility, individual demand, and many additional factors. Thus, Marshall coined the term *ceteris paribus* in economics meaning "all else being equal." In order for the equations and calculations to work, economists could not account for all the wide-ranging variables pertinent to the problem. Instead, they propose that all the other variables outside the scope of the analysis were constant and in a static state in order to simplify the necessary calculations. This seems like a rather myopic solution as a market relies on several variables and impacts a myriad of others; a change in one value influences a list of other unknowns. Accuracy was sacrificed for precision in economic models.

Marshall brought economics even further into the abstract by adding the dimension of time to his analysis of supply and demand. He posits that in the short run, demand (i.e individual preferences) dictates where prices will settle. Supply is fixed in the short run, so price is solely determined by the demand function. This supports the views of the neoclassicals and their focus on demand side economics. However, in the long run, price is restricted by variables such as cost of production and wages. Therefore, a change in demand will only result in a change of quantity produced, not price. The long run graph aligns with the beliefs held by the classical economists. Marshall brought both demand side and supply side economics together, appeasing everyone. Between the long run and short run, there was an intermediary graph, Marshall claimed. Here, both supply and demand functions were necessary to determine price and quantity. This is the Marshallian cross that most people now associate with the common supply and demand graph. Strathern argues that as economics was being more universally applied in the real world, it was

becoming more of an academic field that explores the theoretical realm, rather than that of the world at large.[39]

The rise of neoclassical economics can also be attributed to the decreasing influence of moral philosophy on economics. The downfall of the labor theory of value meant a redefinition of wages and how they are distributed. Subsistence level wages emphasized by Ricardo's Iron Law of Wages fell apart with no historical evidence or support. The marginalists discovered the solution to the issue with paying fair wages. Namely, wage is determined by marginal product. Moral considerations are not pertinent anymore because the neoclassicists have formulated a series of simple equations. The origins of this mathematical approach can be traced to this time period which has since shaped the path of economics to its modern, impersonal state.

Opposition to Neoclassicism

Knut Wicksell saw economics heading in the wrong direction, with its focus on abstract theory, and wanted to right its path. Interestingly, he did not fault capitalism or neoclassicism itself for the troubling developments in the field. Instead, he claims that the neoclassical writers themselves were to blame for their shortsighted viewpoints on economic issues. Wicksell argues that too many economic writers are cloistered in universities and academia, far away from the real issues plaguing urban centers.[40] Ironically, Wicksell further developed ideas that pushed economics into the abstract realm in his book, *Interest and Prices* (1898). He set forth the necessary conditions for marginal product of labor and capital to sum up to gross domestic product. He claimed that perfect competition and constant returns to scale were a requirement for

[39] Strathern. (2001) p. 227
[40] Pressman, S. (2013). *Fifty Major Economists* (p.119). Routledge.

the calculations to work out. Yet, these components are highly theoretical and very rarely representative of real world markets.

Similarly, Thorstein Veblen, one of Wicksell's contemporaries, held a negative view regarding the recent developments in economics. Veblen disagreed with the rational, self-interested economic agent at the foundation of neoclassical models. Instead, he argued that humans are motivated by psychosocial phenomena such as fear, culture, and conformity.[41] One of his major works, *The Theory of the Leisure Class*, asserts that the wealthy class considers itself vastly superior to the working class, even in a biological sense. In fact, Veblen writes that this phenomenon is not new to society; it can be traced back to civilizations including the Vikings in the Middle Ages and Polynesian tribes in the Stone Age. Furthermore, the elite have a strong urge to differentiate themselves from the lower classes. This is reminiscent of Smith's claim that "The rich man glories in his riches because he feels that they naturally draw upon him the attention of the world" (2010, p.50).[42] The urge to purchase goods in order to impress others brings forth a new component to preferences. Consumers not only purchased goods to maximize utility based on how much benefit they would receive from the product, they also took into account sociological implications. He states, "with the exception of the instinct of self-preservation, the propensity for emulation is probably the strongest and most alert and persistent of economic motives proper" (1899, p.110).[43] This rings true even in today's society and is demonstrated by the need to have the newest device on the market. Veblen criticized the neoclassical approach of a rational, maximizing agent because there are these social factors at play as well.

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[41] Strathern. (2001) p. 235
[42] Smith. TMS. (2010) p. 50
[43] Veblen, T. (2005). *The Theory Of The Leisure Class; An Economic Study Of Institutions* (p. 110). Aakar Books.

Veblen continues to critique the current economic stance on business in his other book, *The Theory of Business Enterprises*. Veblen claims that businessmen are far from altruistic and do not wish to allocate resources as efficiently as possible- a sentiment apparent to most people besides economists. He states "efforts are directed, not to maintaining the permanent efficiency of the industrial equipment, but to influencing the tone of the market for the time being, the apprehensions of other large operators, or the transient faith of investors" (1904, p.10).[44] In other words, managers are not solely interested in increasing the efficiency of the production line. Rather, their aspirations lie in gaining market power and deterring competitors from entering the market. Writing during the time of the rise of such monopolies as Rockefeller's Standard Oil, Veblen believed that efficiency and productivity were not the goal of enterprise. Profit, at the expense of workers and other firms, was the true purpose of industry.

The rational economic agent model arose out of the marginalist revolution and became cemented in the discipline by neoclassical economics. However, at every turn the concept of perfectly rational behavior faced opposition. Wicksell grew worried that economics was straying from reality and concentrating too much on the theoretical. Veblen shared some sentiments with Smith but held a more pessimistic view of humanity. Where Smith argued that society must be grounded in a moral and just system, else businesses would lose customers for their unfair practices, Veblen saw that the status quo contradicted Smith's optimism. Corporations were growing larger and held more power than ever before. Instead of converging towards equilibrium

[44] Veblen, T. (1904). *The Theory of Business Enterprise* (p.10). Scribner's Sons.

where price would settle to the marginal cost of production, monopolies were reaping massive profits by maintaining artificially high prices.

Despite the historical events that challenged the reigning economic assumptions, neoclassical economics moved forward. Bank runs in the late 19th century, the rise of monopolies and industry barons, and then the Great Depression provided people with a negative image of economics. Economists truly were becoming more and more removed from the real world as the discipline became an academic powerhouse.

John von Neumann and Oskar Morgenstern

The pinnacle of theoretical economics is game theory. Formulated by John von Neumann and Oskar Morgenstern in the 1940s, game theory attempts to reduce all economic activity to mathematical calculations. Von Neumann did not start his career in economics. Initially, his intellect drew him to chemistry and mathematics. Even in those fields, he took a heavily mathematical approach to developing groundbreaking theories. His accomplishments in quantum theory and mathematics, however, were overshadowed by other scientists and it was only afterwards that von Neumann was introduced to economics by fellow Hungarian colleague Nicholas Kaldor. He began his investigation of the field with Walras's *Elements of Pure Economics* and immediately criticized the theories he found within. Ironically, von Neumann challenged the technical view of markets and equilibrium. According to him, the markets did not move because the unemployment rate, for instance, mediated other variables. Rather, it was the participation of human actors in the market that influenced its movement and led to fluctuations

and equilibrium. It was this fascination about how individuals interact with one another that led to the development of game theory.

One of the first fundamental components of game theory was the minimax theorem. Von Neumann asserted that this notion would provide actors with the best strategy to choose in practically any setting. According to the minimax theorem, actors should analyze the maximum possible loss to each possible strategy available to them. The optimal strategy, therefore, is the one that minimizes the maximum possible loss. Thus, von Neumann's theorem was less about winning in all scenarios and more about avoiding losses.

Further developments in game theory were made possible with the collaboration of von Neumann and Morgenstern starting in 1939. Morgenstern was ambitious and wished to formulate a theory "in the truly scientific spirit" (Nasar, 2011, p. 85).[45] Both Morgenstern and von Neumann shared the belief that economics was not scientific enough as a discipline. This was not to say that all of economic theory was incorrect. Instead, they claimed that the field merely explained market phenomena without describing the mechanisms operating behind the scenes. Their drive pushed them to define a set of axioms that would establish the theoretical framework for the rest of economics. Their wishes came true as game theory became the cornerstone of economics and rational thinking became the dominant view in the discipline. Von Neumann wholeheartedly believed that his theories would explain and perfectly predict human behavior in the market. In fact, his biographer writes, "If the von-Neumann Morgenstern belief were indeed justified… the problem of wise choice and rational action would be reduced to a matter of calculation" (Heims, 1982, p. 293).[46]

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[45] Nasar, S. (2011). *A Beautiful Mind* (p.85). Simon and Schuster.
[46] Heims, S. J., & Bailey, D. W. (1982). John von Neumann and Norbert Wiener, from Mathematics to the Technologies of life and death. *American Journal of Physics*, *50*(4), 293.

The four axioms von Neumann and Morgenstern settled on were completeness, transitivity, independence, and continuity. Completeness signifies that for every option *x* and *y* either *x* is weakly preferred to *y* or *y* is weakly preferred to *x*. Transitivity applies the same principle as the transitive property of mathematics; if *x* is weakly preferred to *y* and *y* is weakly to *z* then *x* is weakly preferred to *z*. The continuity axiom explains how probabilities of a set of choices must add up to one and there exists a point where an agent is indifferent between the middle option and the combination of optimal choice and the least optimal choice.[47] Lastly, the independence property of expected utility theory states that when the choice between two options has identical components, the agent can isolate those and only consider the pertinent and unique prospects. Moreover, game theory claims that economic agents are mutually rational and have mutually consistent beliefs. In other words, individuals are aware that other players will act rationally, and they believe that they are correct about the actions of the other players.

With the major, 600-page work, *Theory of Games and Economic Behavior,* published in 1944, the two authors now turned to showing its wide applicability in the real world. Von Neumann, in particular, showed interest in international affairs. Combined with his past experience in chemistry and quantum physics, he found himself appointed to the Atomic Energy Commission in the midst of the Cold War. Von Neumann actually advocated for striking the USSR before they had a chance to act, which was the optimal option according to game theory. However, the payoff matrix of a nuclear war with the Soviet Union was dramatically simplified and could not possibly account for all the variables relevant to the issue. Thus, game theory presents an oversimplified view of extremely complex human behaviors. The assumption of

[47] For all P, Q, R, in Δ with P>Q>R, there exists $\alpha \in (0,1)$ such that $\alpha P + (1-\alpha)R \sim Q$.

mutual rationality and mutual consistency greatly exaggerates the accuracy with which people reason. Von Neumann's stance on issues regarding international relations and his insistence on applying game theory to all aspects of life led one psychologist to remark that von Neumann was losing aspects of his consciousness and forgetting what it meant to be human.[48]

Game theory built on the push for economics as a hard science which has its roots in the marginal revolution in the 1870s. The neoclassical school insisted on developing mathematical models to explain economic phenomena and human behavior in the market. It was not until game theory that this goal was realized. Von Neumann and Morgenstern wrote an extensive description of the social interactions that drive market fluctuations and believed that they accurately modelled decision-making. Yet, the rigid framework and concrete assumptions at the core of game theory were unable to account for many behaviors and actions observed in reality. Perhaps it illustrated a highly extensive normative model of how agents should act in a market, but it was not a positive model of how people do in fact behave.

[48] Strathern. (2001) p. 284

Chapter Two: Behavioral Economic Research

The notion of rationality in economics implies that individuals use all available and relevant information they possess in order to evaluate a choice and then make a decision. Behavioral economics research challenges this information processing method due to its inefficiency. Simon (1955) was one of the first economists to develop a formal theory of decision-making that directly counters the rational agent model in economics.[49] He claimed that there are restrictions to rational decision-making in the form of time constraints, cognitive load, and the importance of the decision itself. Simon's model suggests that individuals do not always maximize their own utility. Rather, they find a satisfactory solution or choice that is good enough and do not go through intensive mental reasoning.

Expected Utility Theory

One model at the cornerstone of economics is expected utility theory, which illustrates how a rational agent makes decisions under risk or uncertainty. Since the model deals with risk, it lies at the foundation of economics as it can be applied to insurance, investing, retirement funds, and a myriad of uncertain prospects. The origins of expected utility theory can be found in Bernoulli's work in the 18th century, but the theory was not formalized until 1944 with the collaboration of von Neumann and Morgenstern.[50] Expected utility theory actually arose during their formulation of game theory, and the two rely on one another.

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[49] Simon, H. A. (1955). A Behavioral Model Of Rational Choice. *The Quarterly Journal Of Economics*, *69*(1), 99-118.

[50] Von Neumann, J., & Morgenstern, O. (2007). *Theory Of Games And Economic Behavior*. Princeton University Press.

Expected utility theory assumes that people's preferences are continuous, complete, transitive, and independent. Additionally, it assumes stable preferences across time and under risk. The theory evaluates choices by multiplying the utility of a gamble by the probability of it occurring. According to expected utility theory, rational agents choose between two prospects by maximizing utility using the following function $EU= u(x)p + u(y)q$.[51]

One of the main tenets of expected utility theory is that choices are evaluated based on final states. In essence, the model claims that people choose between outcomes and which one will make them better off. This seems accurate and intuitive when interpreting risk in the positive domain. However, a potential loss in wealth is perceived differently from an equivalent, possible gain. The idea that final states are not the critical factor in decision making should not seem far-fetched to economists. The marginalist revolution in the 1870s demonstrated that consumers make decisions on the margin. Moreover, valuation of a good is based on its marginal benefit rather than its global supply and scarcity. Nevertheless, expected utility theory relies on final states as determinants of decision making.

Expected utility did not go unchallenged for long. One of the first examples of its downfall is the Allais paradox (1953).[52] The paradox illustrates a clear violation of expected utility theory, particularly the independence axiom. The following two sets of prospects are taken from Kahneman and Tversky's (1979) example of the Allais paradox. First, choose between two gambles. Gamble A is $2,500 with a probability of 33%, $2,400 with probability 66%, or $0 with probability 1%. Gamble B is $2,400 for sure. The second set goes as follows. Gamble C is $2,500 with a 33% chance or $0 with a 67% chance. Gamble D is $2,400 with 34% chance and

[51] Rubinstein, A. (2012). *Lecture Notes In Microeconomic Theory: The Economic Agent*. Princeton University Press.
[52] Allais, M. (1953). La Psychologie De L'homme Rationnel Devant Le Risque: La Theorie et L'experience. *Journal De La Societe De Statistique De Paris, 94*, 47-73.

$0 with 66%. The choice sets are summarized in a table below. During research studies, participants chose Gamble B 82% of the time and Gamble C 83% of the time. The results regarding gamble B imply the following utility function: u(2,400) > .33u(2,500) + .66u(2,400) which simplifies to .34(2,400) > .33(2,500). Thus far, an agent can still exhibit such preferences without any red flags. However, for participants to also prefer Gamble C over Gamble D presents an issue. That choice implies the following utility function: .33u(2,500) > .34u(2,400). This is the reverse inequality from the previous choice set. Rational agents are supposed to have stable preferences, but the Allais paradox demonstrates that is not always the case. Moreover, the independence axiom states that a rational decision-maker will isolate identical choices, cancel them out, and make a choice based on preferences over the unique components.

Gamble A	$2,500 w/ 33% chance $2,400 w/ 66% $0 w/ 1% chance	Gamble C	$2,500 w/ 33% chance $0 w/ 67% chance
Gamble B	$2,400 for sure	Gamble D	$2,400 w/ 34% chance $0 w/ 66% chance

Heuristics

Although the Allais paradox was discovered in 1953, it was considered to be just an anomaly. It pointed to a trivial flaw in expected utility theory, and in no way did it undermine its reputation or presence in economics. Allais may have been the first to formally describe a flaw in expected utility theory, but he was certainly not the last to conduct research in that area. Kahneman and Tversky (1974) investigated heuristics to find several more instances in which

individuals violate the model. They were able to demonstrate that people use cognitive shortcuts to answer questions and make decisions. The three major heuristics that receive the most scholarly attention are availability, representativeness, and anchoring.

The anchoring effect occurs when individuals "consider a particular value for an unknown quantity before estimating that quantity" (Kahneman, 2011, p. 119).[53] Anchoring is a powerful psychological phenomenon because even irrelevant anchors are able to influence estimates. For instance, after spinning a rigged wheel of fortune, participants' estimates of the percentage of African countries in the UN corresponded to the low or high anchor they had just seen (Tversky and Kahneman, 1974).[54] The number from the wheel has nothing to do with the quantity of African nations in the UN. Nevertheless, a low anchor correlated with a low estimate and a high anchor with a high estimate. Therefore, anchoring already presents a violation of the assumption of rational decision making. People are using extraneous information in their reasoning, letting uninformative anchors impact their judgments.

Further research on the anchoring effect provided the necessary conditions for anchoring to occur. Taking the side of the rational agent, if the experimenter warned participants about the presence and effect of an anchor, a rational decision maker should be able to discount the influence of the anchor and adjust the estimate. However, both Wilson et al. (1996)[55] and Quattrone et al. (1981)[56] demonstrate that revealing the anchor to participants and making them

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[53] Kahneman, D. (2011). *Thinking, Fast And Slow*. (p.119). Macmillan.
[54] Tversky, A., & Kahneman, D. (1975). Judgment Under Uncertainty: Heuristics And Biases. In *Utility, Probability, And Human Decision Making* (p. 141-162). Springer Netherlands.
[55] Wilson, T. D., Houston, C. E., Etling, K. M., & Brekke, N. (1996). A New Look At Anchoring Effects: Basic Anchoring And Its Antecedents. *Journal of Experimental Psychology: General*, *125*(4), 387.
[56] Quattrone, G.A., Lawrence, C.P., Finkel, S.E., & Andrus, D.C. (1981). Explorations In Anchoring: The Effects Of Prior Range, Anchor Extremity, And Suggestive Hints. In Gilovich, T., Griffin, D., & Kahneman, D. (2002). *Heuristics And Biases: The Psychology of Intuitive Judgment*. Cambridge University Press.

aware of its impact did little to diminish its effect. In fact, even when participants reported that they were not influenced by the anchor, the effect was still present. Evidently, conscious awareness of the anchor did not mitigate it, suggesting that there is an unconscious mechanism at play.

Similarly, monetary incentives did not reduce the size of the anchoring effect. Economists argue that incentives motivate people to be more careful with their judgments and increase the importance placed on the decision. Experimental data show that providing participants with cash prizes for accurate estimates did not decrease the anchoring effect, although it did reduce the participants' ratings of the anchor's influence. This finding further supports the notion that individuals struggle to properly adjust their estimates. Being aware of an anchor and trying to reduce its influence can backfire and simply diminish the perception of the anchor itself. Therefore, incentives may have had a neutral, if not converse, effect on reasoning. The participants falsely believed that they had discounted the anchor when in fact they had not, resulting in an insufficient adjustment.

Anchoring resembles other psychological phenomena and biases. Chapman and Johnson (2002) categorize it as a type of confirmation bias.[57] The individual considers how the anchor is similar to the target quantity but fails to recognize how different the two quantities are. Anchoring is classified as a priming and attentional mechanism as well. A comparative judgment is not necessary for the anchoring effect to occur. As long as the anchor becomes salient through significant processing, it will influence a later judgment (Wilson et al., 1996).[58] Hence, anchoring is considered an attentional heuristic that leads to an associative error. Furthermore, some

[57] Chapman, G. B., & Johnson, E. J. (2002). Incorporating The Irrelevant: Anchors In Judgments Of Belief And Value. *Heuristics And Biases: The Psychology Of Intuitive Judgment*, 120-138.
[58] Wilson, et al., (1996).

researchers argue that anchoring takes place in the information retrieval stage of information processing. In particular, the anchor makes similar and nearby numbers more readily available for recollection. Therefore, anchoring may be related to the availability heuristic.

Sherman et al. define cognitive availability as "the ease with which this outcome can be pictured or constructed. The more available an outcome is, the more likely it is perceived to be" (1985, pg. 118).[59] In other words, after imagining a scenario it becomes subjectively more likely to happen. Consequently, a situation that is easier to imagine should yield a higher probability than a difficult to imagine one. Sherman and his colleagues ran an experiment to uncover whether that hypothesis is true. Half of the participants read about a disease that was prevalent among college students in Arizona while the other half read the same information but also had to imagine contracting the illness and experiencing the symptoms for three weeks. Furthermore, each group was split in half again, with one half given symptoms that were easy to imagine, typical and specific symptoms, whereas the other half read about ambiguous, harder to imagine symptoms. The results confirmed the hypothesis; the participants who had to imagine the unambiguous symptoms rated themselves more likely to contract the disease than the participants who had the difficult-to-imagine symptoms.

The availability heuristic acts as a cognitive shortcut that undermines the rationality of decision making. Kahneman explains heuristics by stating that the question at hand is replaced by a simpler question and only then is an answer produced. In the case of the availability heuristic, a question asking about the probability of a situation is replaced by the question- how

[59] Sherman, S. J., Cialdini, R. B., Schwartzman, D. F., & Reynolds, K. D. (1985). Imagining Can Heighten Or Lower The Perceived Likelihood Of Contracting A Disease: The Mediating Effect Of Ease Of Imagery. *Personality And Social Psychology Bulletin*, *11*(1), 118-127.

easily can I come up with examples of this scenario? A rational agent would not be influenced by the effect of availability and ease of recollection.

The source of the availability heuristic may stem from two distinct mental processes. Schwarz and Vaughn (2002) want to distinguish ease of recall from content of recall in order to better understand the cognitive shortcut.[60] In essence, when making a judgment is it the relative ease of recalling relevant information that shapes a judgment or the actual content generated through accessing memory? To test for these effects, Wanke et al. (1995)[61] ran an experiment similar to Kahneman and Tversky's (1973)[62] first availability heuristic research experiment. They asked participants to write down ten words beginning with the letter *t* and ten words with *t* as the third letter. The new condition that Wanke and colleagues added was a sheet of paper with the letter *t* as a watermark running all across the page. One group was told that the watermark would ease the recollection of words beginning with *t* (facilitating condition) and another was told that the sheet of paper would hinder their ability to recall those words (inhibiting condition). The results demonstrate that the participants in the facilitating condition adjusted their judgments to claim that there are more words with the letter *t* in the third position than words that begin with *t.* Conversely, those in the inhibiting condition, judged words that begin with *t* as more common. The experiment identifies that ease of recall is the primary source of the availability heuristic. Individuals adjust their judgments if they are aware that an external force is influencing their decision, yet they end up distorting their estimate in either case.

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[60] Schwarz, N., & Vaughn, L. A. (2002). The availability heuristic revisited: Ease of recall and content of recall as distinct sources of information.

[61] Wänke, M., Schwarz, N., & Bless, H. (1995). The Availability Heuristic Revisited: Experienced Ease Of Retrieval In Mundane Frequency Estimates. *Acta Psychologica*, *89*(1), 83-90.

[62] Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive psychology*, *5*(2), 207-232.

The final, major heuristic identified by Kahneman and Tversky is representativeness. They define the phenomenon as "an assessment of the degree of correspondence between a sample and a population, an instance and a category, … between an outcome and a model" (Tversky and Kahneman, 1983, pg. 296).[63] The representativeness heuristic replaces a question involving probability with a question regarding similarity. Representativeness leads to a significant but seemingly easily avoidable miscalculation called the conjunction error. The mistake refers to a judgment which places a higher probability on *A&B* happening than on just *A*. Even though the first set is contained within the second, people frequently fall into the trap of representativeness and assign too high a probability to *A&B*.

Kahneman and Tversky's (1982) classic example provides participants with a description of two fictional individuals, Bill and Linda, and then asks them to rate how each character resembles a certain occupation. The findings indicate that people rate Linda as more likely to "be a bank teller and active in the feminist movement" than "to be a bank teller." Surely, the profile of Linda given to participants lends itself to imagining a woman active in the feminist movement, but the questionnaire asked about the probability of her belonging to various groups and occupations. This illustrates how the question of probability is replaced by a question of similarity.

Thus far, the conjunction error seems trivial because the experimental setting was constructed to exploit the cognitive bias. However, the mistaken judgment also extends to other populations, including medical experts, which is more concerning. After reading about the symptoms of a particular patient, practicing physicians judged the likelihood of certain ailments.

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[63] Tversky, A., & Kahneman, D. (1983). Extensional Versus Intuitive Reasoning: The Conjunction Fallacy In Probability Judgment. *Psychological Review*, *90*(4), 293-315.

The results indicate that every time, the combination of an unrepresentative disease with a probable one was judged as more likely than just the unrepresentative illness. On average, 91% of medical professionals fell prey to the conjunction error.

Representativeness and the conjunction error can be found universally; a simple reasoning error that is quite pervasive. When confronted with the apparent trap of conjunction, most participants recognize their miscalculation and understand their mistake. In some instances, however, like in the case of the Linda example, participants still struggle to properly apply probability. It appears that people are not as sophisticated in statistical reasoning as they think they are. Most fail to recognize nested scenarios. In order to fully comprehend probability, people need to know when to apply it and when other information should take precedent.

The three major heuristics uncovered by Kahneman and Tversky can no longer be considered mere anomalies. The experiments demonstrate systematic departures from perfectly rational reasoning. Such cognitive biases violate the principle of rational thinking by illustrating that people utilize mental shortcuts to more efficiently process information. Rational thought implies using all available and relevant information to form a judgment or make a decision. Conversely, heuristic research shows that irrelevant information can influence our judgments, referring to anchoring, and some information tends to be overlooked. In other instances, however, information can be given too much weight, as seen in the studies on the availability heuristic. Furthermore, a rational actor is believed to have a strong and comprehensive understanding of statistics and probability. Yet, the presence of the conjunction error, even in decisions made by experts, indicates a lack of complete knowledge of probability. In general, decisions are not made independently, they exist in relation to other decisions and are influenced

by weighted pieces of information. The rigid axiomatic structure of game theory lacks the flexibility to accurately predict decision-making in these contexts.

The aforementioned research paints heuristics in a predominantly negative light, by implying that these phenomena trick our minds into making inaccurate judgments. However, heuristics arose for a reason. They are cognitive shortcuts that allow for more efficient reasoning. In the aggregate, heuristics will result in a generally accurate estimate or judgment. The experiments presented above are designed to exploit and emphasize the effect of heuristics which are used in everyday lives. Overall, these cognitive processes reduce cognitive load and allow our attentional mechanisms to remain alert and not overworked. Nevertheless, the rigid foundation of rational thinking in economics does not account for these heuristics, and they present a challenge to the models that rely on perfect rationality.

Prospect Theory

In 1979, Kahneman and Tversky introduced an alternate to expected utility theory called prospect theory. Prospect theory is able to account for the departures from perfect rationality and stable preferences. The theory puts forth a formula to evaluate two choices under risk. It asserts that an individual will choose a prospect to maximize utility where $V= v(x)\pi(p) + v(y)\pi(q)$. In this equation, v is a value function, x and y are the prospects, p and q are the probabilities of receiving x and y respectively, and π is a function that weighs the probability. The major change in this formula compared to expected utility theory is the weighting of probability. Prospect theory posits that individuals overweight low probabilities and underweight high probabilities. Thus, probability is not a linear function in people's minds. Rather, it depends on subjective

perceptions. Individuals place decision weights on probabilities that distort their magnitudes. This effect is particularly powerful at the tail ends of the distribution. Gonzalez and Wu (1999) show that participants regard a prospect of a 5% chance of $100 as being worth $10, in which case they overweight the low 5% chance.[64] Moreover, people judged a 90% chance of $100 as being equivalent to $63, indicating an underweighting of high probabilities.

The four crucial features of prospect theory are reference dependence, loss aversion, diminishing sensitivity, and probability weighting as mentioned above. Reference dependence directly counters expected utility theory's reliance on final states. Prospect theory emphasizes the importance of relative gains and losses, in other words, the change from a reference point. Kahneman and Tversky (1979) defend this point by stating that the perceptual mechanisms in our brains work on a similar basis. Namely, perception is a judgment made in conjunction with an experience of the past. For instance, our experience of temperature is based on relative changes. In one study, participants were asked to immerse one hand in a bowl of frigid water and the other hand in a bowl of hot water for one minute. Afterwards, they placed both hands into a bowl with room temperature water and asked to judge how each hand felt. The hand from the cold water experienced warmth whereas the hand from the hot bowl felt cold (Kahneman et al., 1993).[65]

Similarly, consider the following scenario presented by Kahneman (2003) : Two people receive a report from their investment broker.[66] The first individual, *A,* learns that their wealth

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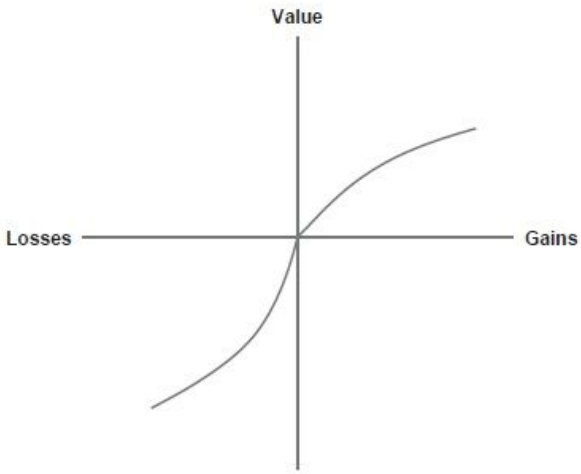
[64] Gonzalez, R., & Wu, G. (1999). On The Shape Of The Probability Weighting Function. *Cognitive Psychology*, *38*(1), 129-166.
[65] Kahneman, D., Fredrickson, B. L., Schreiber, C. A., & Redelmeier, D. A. (1993). When More Pain is Preferred to Less: Adding a Better End. *Psychological Science (0956-7976)*, *4*(6), 401-405.
[66] Kahneman, D. (2003). Maps Of Bounded Rationality: Psychology For Behavioral Economics. *The American Economic Review*, *93*(5), 1449-1475.

has gone from four million dollars to three million dollars. The second individual, *B*, is informed that their wealth has gone from one million dollars to one and a quarter million dollars. Now think about the following questions: Who has more reason to be satisfied with their financial situation? Who is happier? In absolute terms, person A should be happier with their situation because their total wealth is higher. However, it is easy to understand that person B is more content because their wealth increased and that change ultimately gives them more utility and psychological pleasure. This highlights the usefulness of reference points found at the core of prospect theory. The status quo, or an individual's current wealth, typically serves as the reference point. People evaluate a risk based on their financial situation in addition to their risk tolerance. In some cases, Kahneman and Tversky note that the reference point could be defined as the anticipated level of wealth. Take, for instance, a stock broker who purchases a large number of shares. Depending on his investment strategy or goal, he may consider his reference point the price at which he bought the stock or perhaps his expectation of how much the stock should cost. In the former scenario, if the stock rises he will experience a gain and positive utility, whereas in the latter situation if the stock does not reach the anticipated price, he will consider it a loss.

The previous scenario also touches upon another attribute of Kahneman and Tversky's model - loss aversion. They provide the following graph that depicts a typical utility function under prospect theory. The fact that the value function is not symmetrical across the origin indicates that individuals experience the disutility of a loss as greater than the satisfaction from an equivalent gain. The psychological pain associated with a loss results in loss aversion.



Loss aversion also ties into the different behaviors under risk. Prospect theory reports that people are risk averse in gains, but risk seeking in losses. For instance, most people prefer $3000 for sure over an 80% chance of $4000. Note that under expected utility theory the second choice corresponds with a higher payoff and is the predicted option. Now, to reverse the gambles into the negative domain, consider the choice between losing $3000 for sure or losing $4000 with an 80% chance. In this case, most participants chose the risky option, although expected utility again predicts the opposite outcome. Prospect theory allows for more complex value judgments under risk, explaining why people seek risk in losses but avoid it in positive gambles.

Diminishing sensitivity also refers to the slope of the value function. As the monetary amount increases, and moves further from the origin, people experience smaller gains in psychological value. Similarly, as losses grow, the additional disutility increases but at a slower rate. Kahneman and Tversky argue that the difference in emotional response between winning $100 and $200 is much greater than the difference between winning $1100 and $1200. This

further supports the notion that individuals evaluate choices based on relative changes rather than final states.

Prospect theory is now nearly forty years old and remains the best descriptive model of behavior under risk (Barberis, 2013).[67] Yet, prospect theory is still not widely applied in economic theory and has only recently begun gaining traction in the general field. Although the seminal paper was published in *Econometrica,* the authors are psychologists so their research methods differ from that of economists. Economists were initially skeptical that their data would be relevant outside a laboratory setting. Secondly, Barberis (2013) argues that the theory is intrinsically difficult to apply to traditional economic models though it retains its validity outside a laboratory setting. For instance, he asks what type of portfolio an investor will choose given they have preferences that align with prospect theory. As mentioned earlier, the complicated part of the analysis in this scenario is determining the reference point. Does it apply to the investor's total wealth or just the value of the portfolio? Furthermore, is a gain any positive return on the stock or a return above what the investor expected to earn? The complexities of pinpointing a reference point in these types of situations led many economists to avoid prospect theory. Fortunately, he describes how a range of subfields in economics have recently utilized prospect theory to refine their research and made progress in rationalizing some behaviors.

In the field of finance, prospect theory can explain why positively skewed stocks are often overpriced, over-purchased, and yield lower than average returns (Barberis and Huang, 2008).[68] A positively skewed stock simply means that the right tail of its distribution is longer

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[67] Barberis, N. C. (2013). Thirty Years Of Prospect Theory In Economics: A Review And Assessment. *The Journal of Economic Perspectives*, 27(1), 173-195.

[68] Barberis, N., & Huang, M. (2008). Stocks As Lotteries: The Implications Of Probability Weighting For Security Prices. *The American Economic Review*, *98*(5), 2066-2100.

than its left tail. In other words, the stock has an extremely low chance of becoming highly valuable. Nevertheless, given that prospect theory predicts people will overweight low probabilities, these positively skewed stocks appear more valuable to investors although they typically have low rates of return. Prospect theory explains why people will overprice such stocks that have a slim potential of becoming "the next Google" (Barberis, 2013, p. 181). This contrasts the expected utility model in that people have an overly optimistic expectation of the stock's price. Moreover, data from the stock market indicates that positively skewed stocks normally have below average returns. In other words, the chances of moving into that right tail region is extremely low. Expected utility theory fails to account for the empirical data that individuals overprice these skewed stocks that offer small returns whereas prospect theory can model such behavior.

Loss aversion is also able to account for the seemingly strange behavior of investors regarding high earning stocks. Research indicates that brokers and other trading experts are more likely to sell stocks that have a positive return than they are to sell stocks with a negative return (Odean, 1998).[69] Furthermore, stock market data show that well performing stocks continue their upward trend whereas those in the negative typically fail to gain positive momentum. Investors hesitate to sell losing stocks because of the convexity of the value function over losses (Shefrin & Statman, 1985).[70] Recall that prospect theory claims individuals are risk seeking for losses but risk averse over gains. Traders refuse to sell underperforming stocks on the off-chance that they begin to do well and break even.

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[69] Odean, T. (1998). Are Investors Reluctant To Realize Their Losses?. *The Journal Of Finance*, *53*(5), 1775-1798.
[70] Shefrin, H., & Statman, M. (1985). The Disposition To Sell Winners Too Early And Ride Losers Too Long: Theory And Evidence. *The Journal Of Finance*, *40*(3), 777-790.

Prospect theory has been applicable in explaining how wages influence labor supply. The research focuses on taxi drivers because those workers are able to choose how many hours they work each day, an assumption common to traditional labor models. Data on cab drivers demonstrate an inverse relationship between number of hours worked and the hourly wage (Camerer et al., 1997).[71] Cab drivers set a target income for each day and typically stop working as soon as they hit that value. On days when the demand for taxis is high, the drivers reach their goal more quickly and work fewer hours. However, on slower days the drivers must work for a longer amount of time in order to reach their target income. The loss aversion component of prospect theory supplements this analysis by explaining that not achieving the set target by $30 feels disproportionately worse than the joy felt when surpassing the goal by $30. Traditional economic models that uphold the assumption of perfect rationality fail to resolve this behavior. A rational agent would work longer hours when the demand for cabs is higher to compensate for the days when demand and hence wages are lower.

The previous studies demonstrate modes of thinking that violate the economic definition of rationality. People are loss averse and use cognitive shortcuts in their reasoning. Moreover, individuals have a less than perfect understanding of statistics, which leads to calculation errors in risk and other decisions. The anchoring heuristic illustrates how irrelevant values can distort judgments, and people fail to discount extraneous information during information processing. The following literature explores further departures from von Neumann and Morgenstern's model, which illustrated economic agents as income maximizers.

[71] Camerer, C., Babcock, L., Loewenstein, G., & Thaler, R. (1997). Labor supply of New York City cabdrivers: One day at a time. *The Quarterly Journal of Economics*, *112*(2), 407-441.

Prosocial Behaviors

The traditional, economic notion of self-interest and rationality seems to preclude high rates of prosocial behaviors and altruism. Altruism appears at odds with self-interest; why would an egoistic agent behave in a way that increases another individual's welfare? The foundation of von Neumann and Morgenstern's game theory rests on the assumption that an economic agent will try to maximize their own utility. Moreover, there are skeptics that deny the existence of pure altruism- the idea that an altruistic action has no egoistic motive behind it. Even selfless acts can be framed into self-interested ones by claiming that the actor wants to relieve their own distress or discomfort, they desire praise, or they wish to avoid shame (Batson, 2013).[72] The debate has gone on through the centuries and much of Western philosophy has sided with the skeptics, insisting that even the most altruistic acts can be traced to egoistic origins. For the intents and purposes of this essay, the more pertinent question is whether altruistic (or pseudoaltruistic) actions violate the principle of rationality.

Although Adam Smith believed in the capacity for people to do good and to cooperate in society, he too asserted that self-interest was at play. However, Smith's concept of self-interest was quite different from the form it has taken today. He incorporated the needs of others into his framework and understood the power of empathy and compassion inherent to human nature. The perception of self-interest has become distorted over the years and can account for the misconceptions many people have for the term. Oliver Williamson, a Nobel prize winning economist, writes that rational agents are characterized by "self-interest seeking with guile [which] includes...forms, such as lying, stealing, or cheating… [and] more often involves subtle

[72] Batson, C. D. (2014). *The Altruism Question: Toward A Social-psychological Answer*. Psychology Press.

forms of deceit" (Williamson, 1985, p. 47).[73] Smith would likely be appalled by such a negative portrayal of human behavior in the marketplace. In his view, such a society could not survive because consumers care about fairness and would refrain from purchasing goods from unfair sellers. Deceit and cheating was a surefire way to mar one's reputation and ruin a business. Yet, by the late 20th century, such behavior seems to have become normalized.

Recent research has explored whether this negative view of human society is an accurate representation of behavior. Social psychologists have investigated whether economics purports an unrealistic perception of human behavior and continue to identify ways in which some altruistic actions contradict the notion of rationality.

Fehr and Gachter focus their research on reciprocity, which occurs when "the actor is responding to friendly or hostile actions even if no material gains can be expected" (2000, p. 160).[74] Reciprocity can be differentiated further into positive and negative reciprocity. Positive reciprocity denotes cooperative behaviors that reward fair actions whereas negative reciprocity involves retaliation against bad behavior. Instances of positive reciprocity are found in trust games. The trust game is played by two individuals, in which the first receives a sum of money from the experimenter and is asked to share any amount ranging from zero to the whole sum. The second player receives triple the share that the first player sent over. Now the second player has the opportunity to send back any amount to the first player.

Studies find that there is a positive correlation between how much the first player sends over and how much they receive in return from the second player. In other words, the more money the first player is willing to share with the second, the more money they will receive at

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[73] Williamson, O. E. (1985). *The Economic Institutions Of Capitalism*. (p.47). Simon and Schuster.
[74] Fehr, E., & Gächter, S. (2000). Fairness And Retaliation: The Economics Of Reciprocity. *The Journal Of Economic Perspectives*, *14*(3), 159-181.

the end of the game when the amount is tripled. This effect demonstrates a two-fold altruism. The first player gives the second player a larger split of the sum in the hopes that the return will be worthwhile. This does not fall under pure altruism because there is a self-interested motive involved. It does imply, however, as the name of the game suggests, a degree of trust that the second player will redistribute some of the newly accumulated wealth. Additionally, the second player is left with the choice of how altruistically to behave. After receiving the split, they can choose to leave nothing to the first player and act in an entirely self-interested manner. However, the results indicate that people reciprocate generosity if they receive it. There is no opportunity for reputation building. The salient variable is how much the first player was willing to offer in the first round of the game. Interestingly, raising the monetary stakes of the game did not significantly influence the results. When the trust game was conducted in Moscow and participants earned on average ten weeks worth of income in a two hour experiment, the rates of positive reciprocity were still high (Fehr et al., 2002).[75]

Another notable issue that arises from assuming people are income-maximizers is free-riding. Free riding is defined as "the absence of contribution towards the provision of a public good by an individual, even though he or she will not be excluded from benefiting from that good" (Marwell & Ames, 1981, p.296).[76] If contribution is voluntary, then it is in the individual's best interest not to invest in the public good but still reap the benefits from it. The rational agent can maximize his utility by free-riding. Yet, real world data indicate that free-riding is not a monumental issue. One example of supposedly irrational behavior is donating

[75] Fehr, E., Fischbacher, U., & Tougareva, E. (2002). Do high stakes and competition undermine fairness? Evidence from Russia.

[76] Marwell, G., & Ames, R. E. (1981). Economists Free Ride, Does Anyone Else?: Experiments On The Provision Of Public Goods, Iv. *Journal Of Public Economics*, 15(3), 295-310.

to charity. It is an optional behavior that typically has no direct impact on the benefactor's welfare. Still, hundreds of billions of dollars are donated to charity each year (Giving USA).[77]

In a public goods experiment, data indicate that if punishment is possible, a minority of people exhibiting reciprocal behavior can force a majority of self-interested agents into cooperating (Fehr & Gachter, 2000).[78] A public goods game is one in which several participants endowed with a sum of money choose to contribute to a group exchange or a private exchange. Money invested in the group is then split among all the participants, regardless of whether or not they contributed. The private exchange, on the other hand, acts more like a storage place for the money and is returned to the participant. The researchers conduct the experiment with two conditions, one in which punishment is not possible and the second where it is an option, albeit a costly one. In the first condition, economic models predict that every individual will free ride. Additionally, even when punishment is possible in the other experimental setting, self-interested agents will not punish because the action is costly and they want to maximize their own utility.

What they find is that when punishment is absent, a majority of the participants free ride, and those who do contribute to the public good only contribute a small amount. Note that even after ten periods, some participants are reluctant to free ride and deviate from the prediction of traditional economic models. When given the chance to punish free riders, even at a cost, the reciprocal types are able to encourage cooperation. In fact, the study finds that in the final period 82.5% of participants contributed their entire endowment to the public good. The high rate of contribution and cooperation defies economic models especially because such behavior provides evidence of a stable equilibrium, not just an anomalous result. The results do not imply that

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[77] "Giving Statistics." *Charity Navigator*. Giving USA, n.d. Web. 11 Apr. 2017.
[78] Fehr, E., & Gächter, S. (2000). Cooperation and Punishment in Public Goods Experiments. *American Economic Review*, *90*(4), 980-994.

self-interest does not exist. Rather, it demonstrates that even self-interested individuals can act generously under certain conditions. Furthermore, in the punishment condition, individuals are still acting rationally when contributing large amounts to the public good. They realize that free-riding is a costly action and will be punished, so the rational response is to invest in the public good.

Given the examples of behavior violating strict self-interest, economists began developing new descriptive models for decision making. They did not view the results from experimental data as a threat to the discipline, nor did they deem it as completely revolutionary. When new and reliable information challenges the assumptions of traditional models, they are revisited and refined. Thus, behavioral research gave rise to models of social preferences. Fehr and Gachter (2000) proposed a model of reciprocity, as seen above, illustrating how individuals with purely self-interested motives can alter their behavior in order to reward altruism or punish greediness.[79] Another example of a model with social preferences is the inequity-aversion model which shows how individuals want to avoid polar outcomes and prefer to maintain equality (Fehr & Schmidt 1999).[80] Lastly, social welfare models assert that people want to increase social surplus particularly by caring for those who are worse off (Charness & Rabin, 2002).[81]

Crockett et al. (2014) demonstrate how social preferences influence behaviors involving pain.[82] They find that care for others is more salient than self-care. Participants were randomly

[79] Fehr, E., & Gächter, S. (2000). Fairness And Retaliation: The Economics Of Reciprocity. *The Journal Of Economic Perspectives*, *14*(3), 159-181.
[80] Fehr, E., & Schmidt, K. M. (1999). A Theory Of Fairness, Competition, And Cooperation. *The Quarterly Journal Of Economics*, *114*(3), 817-868.
[81] Charness, G., & Rabin, M. (2002). Understanding Social Preferences With Simple Tests. *The Quarterly Journal of Economics*, *117*(3), 817-869.
[82] Crockett, M. J., Kurth-Nelson, Z., Siegel, J. Z., Dayan, P., & Dolan, R. J. (2014). Harm To Others Outweighs Harm To Self In Moral Decision Making. *Proceedings of the National Academy of Sciences*, *111*(48), 17320-17325.

divided into two roles, decider and receiver, and the identity of the other was always kept anonymous. The decider received numerous prompts regarding electric shocks and a monetary amount to either increase or decrease them. Half the time the decider would be given the shocks, and the other times the shock would be administered to the receiver. Since identities remained anonymous, there was no possibility for retaliation, judgment, or reciprocity from the other individual. Nevertheless, the results indicate the presence of altruistic behaviors.

The decider placed more importance on the pain of the receiver than they did on their own pain. Namely, the decider was willing to pay more money to reduce the number of shocks to the other individual. Furthermore, they were less likely to harm the receiver and frequently chose more shocks for themselves relative to their partner. Deciders placed a higher cost on the pain of the other than pain for one's self. In other words, they demanded more money to increase the number of shocks to the receiver than to themselves and were willing to pay more in order to decrease the shocks administered to the other than to themselves.

The researchers argue that these results go against the reigning economic theory that people value their monetary outcome as far more important than the monetary outcome of their peers. This is not conclusive evidence that people are in fact selfless and care more for their neighbors than for themselves. However, the value of the results lies in the fact that even under conditions meant to minimize concerns of reciprocity and punishment avoidance, a majority of participants acted altruistically. Although the paper does not explore in depth the motivating factors behind the altruistic and selfless behavior of the deciders, the results clearly support that social preferences impact decision making. In choosing to accept less money to reduce the pain

of someone else, the decider implies that the welfare of the receiver is an important factor in one's own utility.

Concerns about fairness are influential in pricing models and labor markets. Although the basic model of supply and demand dictates that a demand shock should result in an increase in price, most consumers view such behavior as unfair (Kahneman et al., 1986).[83] Market prices and a history of transactions serve as the reference point for consumers. If a firm increases its price, when costs remain the same and profits are not threatened, the consumer feels slighted and deems the action unfair. Similarly, a firm reducing a worker's wage because of lower wages at competing firms is judged as unfair. However, if that worker leaves and the new employee receives the lower wage, most people view that action as fair.

[83] Kahneman, D., Knetsch, J. L., & Thaler, R. (1986). Fairness As A Constraint On Profit Seeking: Entitlements In The Market. *The American Economic Review*, 728-741.

Chapter Three: Mediating Factors of Decision-Making

The previous chapter illustrated how human behavior differs from predictions of economics models. In particular, people's preferences are not stable over gains and losses, or over time. Observed behavior does not conform to the axioms put forth by von Neumann and Morgenstern. However, these deviations from rationality do not stop there. As the field of behavioral economics grew, the research analyzed more specific demographic data. In order to find the mediating factors behind "irrational" behavior, psychologists and economists alike looked at professions, education, culture, and experience. Interestingly, studies demonstrate that economists, both students with a degree in the field or people experienced in business, perform more rationally than their inexperienced counterparts. This correlation gives rise to questions of validity and accuracy of economic models.

Economics Majors

Returning to the public goods game, Marwell and Ames set up several experiments to investigate contributions while manipulating several variables, including area of study (1981).[84] Participants were given a certain number of tokens which they could then invest in either an individual or group exchange. The individual exchange had a low and fixed rate of return on the investment, regardless of the investment decisions of other players. The group exchange had a significantly higher rate of return but everyone received a share of the tokens invested in the group regardless of who invested in the group. Therefore, the social incentive is to invest all

[84] Marwell, G., & Ames, R. E. (1981).

tokens in the group exchange and everyone profits substantially more than they would in the individual exchange. On the other hand, each participant has the incentive to invest only in the private exchange and free ride on the returns from the group investment.

Before conducting the actual experiment, the researchers sent the procedure and experimental design to six economists, asking them for their predictions on the results based on economic theory. Four of the economists said that no one would invest any tokens in the group exchange and one stated that the invested amount would be less than five percent. The economists, however, did clarify that the participants would likely stray from the theory and invest on average 20% of their tokens in the public good. These amended results were explained by a combination of increased risk taking and participants behaving irrationally.

Already the economists' predictions give rise to skepticism. It is problematic to see that economists are aware that most participants will stray from the predictions made by the models. In that case, should the models be readdressed to account for their lack of external validity? This question will be explored later, after a more thorough investigation into the divergence of economic theory and experimental data.

Marwell and Ames conducted a series of experiments, altering the conditions several times, but found consistent results. The various conditions included providing skewed resources to some participants, using experienced players from previous trials, and a group of exclusively graduate students in economics. Under every condition, the free-riding hypothesis was refuted. Participants in all but one set of conditions invested on average between 40% and 60% of their tokens. This is not the socially optimal amount of investing everything, but it is a substantial difference from the prediction of economic theory and the predictions of the economists citing

irrational behavior. The outliers of the experiment were the graduate students in economics. They only invested on average 20% of the tokens. This finding still contradicts the free-riding hypothesis, but it is significantly different from the other results.

Marwell and Ames' study suggests that economists behave differently from the non-economists. This assertion is strengthened by a survey that the two researchers gave out following the experiment. The questionnaire asked what is a fair amount to invest in the group exchange and whether the participant took into account fairness when making an investment decision. Again the economists stood out. One third of them refused to answer the question regarding a fair amount or gave complex and uncodable responses. Of those who complied and responded, most claimed that a small sum or even no investment was fair. Finally, the economics students were only half as likely as the other students to say that they were "concerned with fairness."

The Marwell and Ames study reveals an interesting gap between economists and non-economists. The economists demonstrated more self-interested behavior, which could in turn be called rational decision making by their fellow peers. However, no one group behaved in accordance to economic theory. How can the theory be reconciled with the experimental data, and more importantly, should it be?

Before delving further into the literature, it is important to understand the ultimatum game because the following studies rely heavily on this task. Developed in 1982, the ultimatum game is a task used to measure fairness and decision making with monetary outcomes (Guth, 1982).[85] Typically, there are two players in every round- a proposer and a responder. The

[85] Güth, W., Schmittberger, R., & Schwarze, B. (1982). An Experimental Analysis Of Ultimatum Bargaining. *Journal Of Economic Behavior & Organization*, *3*(4), 367-388.

proposer receives a sum of money and has to split the money with the second player. The responder receives an offer and decides whether or not to accept it. Should the responder accept, the money is allocated according to the proposer's offer. However, if the offer is rejected, neither player gets any money. The prediction of economic theory is that the responder will accept any positive offer because they will be slightly richer than they were prior to the experiment.

Carter and Irons follow the path of the previous set of experiments but concentrate on the differences between economics majors and students in other disciplines (1991).[86] They set up an ultimatum game scenario with four groups- first year students studying economics, first years not studying economics, seniors majoring in economics, and seniors majoring in anything but economics. Their findings are in line with those of Marwell and Ames. Namely, economics students accept smaller amounts in the ultimatum game and also offer smaller amounts to the partner. In other words, economists behave more closely to the predictions of economic models; however, they are still not perfectly rational. The rational choice, as dictated by economic thought, is to offer the smallest amount possible and the responder to accept any positive offer. Again the true behavior of participants is far off from the expectations of the model.

Carter and Irons also ask the question of whether self-interested behavior is learned throughout the course of study or if students self-select into the major. They find support for the selection hypothesis in that first year economists already accept smaller amounts and propose to keep more for themselves than first year students in other majors. Secondly, the difference in behavior between economics students in their senior year compared to their first year actually narrows. So studying economic models and learning more about the assumption of rationality

[86] Carter, J. R., & Irons, M. D. (1991). Are Economists Different, And If So, Why?. *The Journal of Economic Perspectives*, *5*(2), 171-177.

does little to affect the decision making of students. Therefore, the study finds little support for the learning hypothesis and further reinforces Marwell and Ames' findings.

In another ultimatum game experiment conducted by Kahneman, Knetsch, and Thaler, students at a Canadian University split the money differently depending on the major of the other player (1986).[87] In particular, they found that the most generous offers were made by psychology students to other psychology students. The offers slightly declined when they were being made to students in an economics course and lastly, the economics students offered the least amount of money to the psychology students.

This raises the question of why the students thought it was acceptable to propose various offers depending on the other player. Splitting the money in the ultimatum game cannot simply be explained by fairness in this case because fairness should in theory be applied universally. Did the students feel some sort of solidarity with their peers? Or perhaps they were being guided by the expectations of what the other player would do, assuming that the economists would be willing to accept smaller offers.

Yet another common experiment used in economics is the prisoner's dilemma. The payoff matrix is included below. The current economic theory asserts that people will always defect. Defecting has a higher payoff regardless of the other player's action but if both players defect they receive a lower reward than for cooperating.

[87] Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1986). Fairness And The Assumptions Of Economics. *Journal Of Business*, S285-S300.

		Player *X*	
		Cooperate	Defect
You	Cooperate	2 for *X* 2 for *Y*	3 for *X* 0 for *Y*
	Defect	0 for *X* 3 for *Y*	1 for *X* 1 for *Y*

Frank, Gilovich, and Regan looked at how economics students behave compared to those in other disciplines using the prisoner's dilemma with the above matrix (1993).[88] They found the defection rate for economics students to be 60.4% whereas the defection rate for non-economics majors was only 38.8%. Economists displayed more self-interested behavior and by a significant margin. Even controlling for effects of gender, since economics students are predominantly male and thus less likely to cooperate, the regression analysis showed that economics majors were 17% more likely to defect than other majors.

The study also included three conditions which allowed for some interaction between the players prior to playing the game. The unlimited condition gave the students 30 minutes to talk to the other two players they would be matched with and allowed them to make promises to one another to cooperate, although these promises were unenforceable during the experiment. The second condition did not allow for promises but still gave the participants 30 minutes to talk. Lastly, the third condition only allocated 10 minutes of interaction before the experiment started. The defection rates were highest in the "limited" 10 minute condition, declined in the intermediate condition, and fell significantly when participants were allowed to make promises.

[88] Frank, R. H., Gilovich, T., & Regan, D. T. (1993). Does Studying Economics Inhibit Cooperation?. *The Journal of Economic Perspectives*, *7*(2), 159-171.

Furthermore, the divergent behavior between economics students and others nearly vanishes in the unlimited condition. Of the economics majors, 28% defected, and 26% of the other majors defected in this condition. A promise, though unenforceable, seems to reassure both groups of students into cooperating. The uncertainty and risk of losing, therefore, is at the forefront of the economists' minds and might drive their self-interested behavior.

The considerable difference is shown in the remaining two conditions in which economists defect 72% of the time compared to a 47% defection rate in other students. One possible explanation for this disparity is that economics majors expect others to defect. That is the lesson they were taught in their courses, and if they believe that the other player will defect, it is in their best interest to defect as well. To investigate this possibility, the researchers sent out a questionnaire to students asking what they would do in a scenario in which they were sure that the other player would cooperate. Oddly enough, 58% of economics students claimed that they would still defect. This contrasts the experimental finding of the unlimited condition where 28% of the economists cooperated after making a promise. So although expectations of the other player's action influences the behavior, it does not explain the full picture.

Shafir and Thaler (2006)[89] present how framing shapes mental accounting and can result in odd explanations for purchasing and investing in certain goods. They initially ran an experiment with a group of wine connoisseurs, some of whom happened to be economists. The experiment was twofold in that it included two questionnaires regarding the cost of a bottle of wine. In the first scenario, participants were presented with a situation in which they had purchased a bottle of wine for $20 many years ago and now the market price rose to $75. The

[89] Shafir, E., & Thaler, R. H. (2006). Invest now, drink later, spend never: On the mental accounting of delayed consumption. *Journal of economic psychology*, *27*(5), 694-712.

survey asked how the participants perceived the consumption of the wine, either during a meal or by gifting the bottle to someone. In both conditions, 30% of respondents answered that they felt as if consuming the wine cost them nothing at all. Some participants stated they felt as if they were saving $55, the difference between the current retail price and the price at time of purchase. The normative economic answer which states that consuming the wine feels like it costs $75, was only chosen by a fraction of the respondents, and this was the more likely choice in the "giving away" scenario as opposed to the drinking at dinner example. Furthermore, the "correct" answer, at least by economic standards, was selected primarily by the economists of the group.

The second trial of the study presented equivalent price points for the wine but in this case a friend dropped the bottle and broke it. The questionnaire asked how much of a loss the participants would feel over the broken bottle. In this case, 55% of the respondents answered that the associated cost was $75. Shafir and Thaler refer to this as the replacement cost. The second most popular answer was $20 accounting for 24% of the respondents. The broken bottle example led to a majority of people selecting the right answer- the replacement cost. This was not the case however, in the previous trial. Perhaps consuming the bottle during dinner bears less of a cost because the individual still gets to enjoy the wine. Yet, in the gift giving scenario, the giver does not get to taste the wine so it should be perceived as a more salient loss. However, the feeling of loss is not intense until the bottle is broken. Moreover, the researchers tracked the answers of the participants from one survey to the next and found that nearly two-thirds of them switched answers in the broken bottle scenario. Previously, they responded that the cost of consuming or giving away the bottle was zero or even profitable, but now the replacement cost emerges as more important.

The crucial economic concept at play in the study is opportunity cost. Economists have a strong understanding of this notion, having learned it since the very first introductory economics course in undergraduate studies. Shafir and Thaler argue that breaking the bottle of wine makes participants consider opportunity costs more readily. Similarly, they point out that if the opportunity cost of giving away a bottle equals zero, and breaking the bottle implies that you can no longer give it away, then the cost of breaking the bottle should not be the replacement cost. Nevertheless, the data illustrate some odd results even from seasoned wine connoisseurs and economists.

Although Shafir and Thaler do not mention social preferences, they seem to have a role in these experiments. Namely, in the gift giving scenario, individuals do not consider this action as a loss because it is an act of charity. Handing a gift to a friend has an immeasurable benefit which is not accounted for in the study's analysis. Thus, it is not appropriate to equate giving away the bottle to breaking it. Having the wine all over the floor is certainly a loss and a salient one, but to gift the bottle to someone is perceived differently with the benefit seemingly outweighing the cost. The other important finding from this study was the responses provided by the economists. They were the group that consistently perceived the cost of the wine, in all three scenarios, as a replacement cost. This either indicates that economists place less weight on social preferences, or they frame the scenario differently. Economists may have a more nuanced definition of cost and not discount the benefit of gift giving to formulate a net change in welfare. Perhaps the economists view the wine as more of an investment, akin to a stock portfolio, and judge its value by the market price, regardless of how much they paid for it. Whatever the reason

may be, Shafir and Thaler demonstrate further evidence for the difference in the reasoning processes of economists.

Market Experience

List (2003) conducts a study exploring the endowment effect.[90] In particular, he investigates whether the anomaly that individuals place a value on ownership can be reduced through market experience. In a way, List attempts to answer the same question as Carter and Irons (1991) : do economists behave differently because of their extended exposure to the market, or do they have an inherently different mode of reasoning, or entirely different preferences, that lead them to self-select into the discipline? The power of List's study lies in the fact that his data come from a natural setting rather than a lab. He gathers his data from an actual sports card show and collector pin auction and does not have to don a white lab coat in order to conduct a formal experiment on preferences.

List finds that the endowment effect and the number of market interactions are inversely proportional. In other words, experienced traders do not exhibit signs of the endowment effect. The power of the marketplace leads behavior to converge to neoclassical predictions. The results of List's survey indicate that while approximately 45% of card dealers decide to initiate a trade, only 20% of non-dealers choose to do so. Delving further into the data shows that there is a significant difference between experienced non-dealers and inexperienced non-dealers. This classification is determined by the average number of trades made each month, with experienced non-dealers conducting at least six monthly trades. The data find that inexperienced non-dealers

[90] List, J. A. (2003). Does Market Experience Eliminate Market Anomalies?. *The Quarterly Journal of Economics*, *118*(1), 41-71.

only chose to trade away their endowed good 7% of the time whereas experienced non-dealers agreed to a trade on 47% of occasions. This finding further supports List's claim that market experience correlates to a reduction in the endowment effect.

List highlights that one of the advantages of his study is that the value of either good supplied to the participants is indeterminable. According to a pretest, both goods are worth about the same to experienced dealers but their uniqueness escapes traditional pricing mechanisms. List claims that this eliminates some confounds in his field experiment because individuals should not have preset preferences for either good in the study. However, for inexperienced non-dealers the ambiguous value may lead to confusion. These respondents are not veterans of the sports card market and therefore have difficulty distinguishing the worth of one good over the other. Therefore, they may exhibit the endowment effect because they do not want to regret trading away a good with a potentially higher value. The experienced traders, on the other hand, recognize that both goods are of equivalent value and feel comfortable initiating the trade approximately half the time. Moreover, List (2004) offers the explanation that experienced dealers may receive utility through the very act of trading, which would account for their increased willingness to trade.[91]

List's study, however, still is unable to explain the existence of the endowment effect. People living in today's society should have plenty of market experience. Yet, when these individuals enter a lab or have to answer a questionnaire in the classroom, the endowment effect appears. If the learning hypothesis were true, then market interactions should eliminate this phenomenon by the time people are in college, as most participants are.

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[91] List, J. A. (2004). Neoclassical Theory Versus Prospect Theory: Evidence From The Marketplace. *Econometrica*, 72(2), 615-625.

Factors Behind Fairness

A number of studies have also been conducted that investigate the behavior of children and whether they behave in a self-interested manner. Both Murnighan and Saxon (1998)[92] and Harbaugh et al. (2000)[93] find that the youngest children, those around the age of five years old, act in the most self-interested manner. As they grow older, they begin to grasp the concepts of fairness and equity, particularly proportional rewards or reciprocity. Furthermore, the youngest children are also more likely to accept the smallest offers in the ultimatum game. These age demographic studies suggest that experience does not necessarily teach individuals to act in a more self-interested fashion. Rather, as children develop, their moral principles dictate what a fair split of money, or tokens, is. Camerer (2003) goes so far as to point out that the results from the two studies on children align more with economic predictions than any adult population studied thus far.[94]

The willingness to cooperate or act fairly in the ultimatum game is also mediated by the identity of the other player. For instance, if people are paired with a computer during the experiment (and are aware of that fact) they behave differently than with human agents (Sandoval et al., 2015).[95] The study investigated decision making in both the prisoner's dilemma repeated multiple times and the mini-ultimatum game (mUG). The mUG simply restricts the choices available to the proposer which in this case was (.2, .8), (.5, .5), (.8, .2). Results indicate

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[92] Murnighan, J. K., & Saxon, M. S. (1998). Ultimatum Bargaining By Children and Adults. *Journal of Economic Psychology*, 19(4), 415-445.
[93] Harbaugh, W. T., & Krause, K. (2000). Children's Altruism In Public Good And Dictator Experiments. *Economic Inquiry*, 38(1), 95-109.
[94] Camerer, C. (2003). Behavioral Game Theory: Experiments In Strategic Interaction. *Princeton University Press*.
[95] Sandoval, E. B., Brandstetter, J., Obaid, M., & Bartneck, C. (2016). Reciprocity In Human-robot Interaction: A Quantitative Approach Through The Prisoner's Dilemma And The Ultimatum Game. *International Journal of Social Robotics*, *8*(2), 303-317.

that people were less likely to cooperate with the robotic agent. Furthermore, in a comparable study, De Melo et al. (2009) found that people collaborated more with a computer if it showed moral emotions than if it did not express any emotions.[96] Their results suggest that our perception of the other player influences decision making and can lead to more altruistic behaviors. Further research could explore whether this relates to how we understand the theory of mind. In other words, if we think that the other agent has a mind or consciousness, will we act more fairly with them, or is the decision mediated by our perception of the other's understanding of fairness? Sandoval et al. (2016) also report that people offer the smaller, less fair split of money more often to robot players than they do to human participants. In addition, it was uncommon for people to split the sum equally with the robot whereas that was the modal choice when playing with another person. The data suggest that participants concern themselves less with fairness when dealing with non-human actors. This effect may likely be caused by the fact that robots do not understand the concept of fairness and thus do not feel slighted when they encounter an unfair split. Therefore, the participant does not feel as unjust when playing with a computer and does not receive the disutility from seeming like a greedy individual.

To study the influence of fairness and altruism on decision-making, Forsythe et al. (1994) created the dictator game which is closely related to the ultimatum game, except that the second player does not have any input in the game.[97] Thus, the fear of an offer being rejected is eliminated in this game. The offers theoretically portray purely how altruistic the Proposer, or Dictator, is. Although the offers were significantly lower than those reported in ultimatum game

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[96] De Melo, C. M., Zheng, L., & Gratch, J. (2009). Expression Of Moral Emotions In Cooperating Agents. In *International Workshop on Intelligent Virtual Agents* (pp. 301-307). Springer Berlin Heidelberg.

[97] Forsythe, R., Horowitz, J. L., Savin, N. E., & Sefton, M. (1994). Fairness In Simple Bargaining Experiments. *Games And Economic Behavior*, *6*(3), 347-369.

experiments, the dictators still violated expectations of game theory by frequently offering positive, non-zero amounts. Therefore, even when individuals have no rational reason to offer a non-zero amount and maximize their own profit, they choose to part ways with a portion of the sum, suggesting that the other person's welfare is incorporated into their own utility.

Social preferences can also induce people to make choices that make them worse off. In an atypical study conducted by Ariely and Levav (2000), patrons at a bar were offered free samples of four types of beer.[98] In the first condition, the customers placed their orders sequentially and publicly. Under those circumstances, participants who ordered first were significantly happier with their choice than those who ordered last. The data indicate that there were few instances where a table of four ordered a particular beer twice. Additionally, the experimenters rarely observed a group sharing the samples with one another. Therefore, their aim was not to order one of each sample and divide them up amongst each other. Rather, each individual wanted to be unique and pick a different beer from the rest of the group. Ariely and Levav theorize that the desire for uniqueness leads people to sacrifice personal utility and substitute it for reputational or social utility. In the second condition of this experiment, participants chose their beer order simultaneously and privately, on a slip of paper. The results from these trials show a lack of variety in people's orders. There were far more repeats for a particular sample per table. Moreover, when asked to rate the satisfaction with their choice of beer, people rated themselves just as happy as the first person to order from the previous condition. No longer concerned about their self-image within the group, participants went with

[98] Ariely, D., & Levav, J. (2000). Sequential Choice In Group Settings: Taking The Road Less Traveled And Less Enjoyed. *Journal Of Consumer Research*, *27*(3), 279-290.

the choice that seemed most appealing to them. Evidently, social preferences can also lead to sub-optimal choices.

Influence of Culture

Ariely claims that the desire to express uniqueness is not universal, but rather a product of Western culture. In the West, particularly in the United States, independence and individuality are hallmarks of society. Conformity is portrayed negatively, so people try to distinguish themselves as much as possible. However, in Eastern cultures, the opposite phenomenon rings true. Individuality is seen as breaking off from a group and disregarding social norms. Furthermore, Eastern cultures view conformity as desirable because it demonstrates the cohesiveness of a group (Kim and Markus, 1999).[99] Ariely also conducted a similar beer sample study in Hong Kong to investigate cultural differences (2008).[100] The results indicate that participants also regretted their choice when ordering publicly rather than privately but for a different reason. In this experiment, people regretted their choice because they ordered the same dish or beverage as someone else at their table. It was not individuality that caused the disutility, it was conformity. Yet again, social preferences mediate decision-making but result in undesired choices. Culture and the surrounding social environment impact how people frame their judgments and decisions. This goes beyond the notion in economics that individuals are utility maximizers and only interested in their own personal gain.

Culture also acts as a major factor in playing the ultimatum game. Research studies are often criticized for using unrepresentative samples since participants are predominantly

[99] Kim, H., & Markus, H. R. (1999). Deviance Or Uniqueness, Harmony Or Conformity? A Cultural Analysis. *Journal Of Personality And Social Psychology*, *77*(4), 785.
[100] Ariely, D. (2009). *Predictably Irrational* (p. 316). New York: HarperCollins.

university students, even in studies exploring cross-cultural effects (Roth et al. 1991).[101] Henrich et al. (2001) take their research even further by using participants from 15 small-scale societies. [102] They classify three of these communities as foraging societies, four as nomadic herding groups and so on, demonstrating that these societies have limited, if any, contact with the world at large. Their research finds that the traditional economic model and its predictions are violated universally, in every society tested. However, the nuanced results they find are evidence of the impact culture has on decision-making and prosocial behavior.

The data include extremely small splits as well as quite generous offers surpassing the 50% mark. First and foremost, the societies with the smallest offers still had an average split of over 25% and contradict predictions of the standard economic model. Overall, the mean offers ranged from 26% to 58% while the modal offers went from 15% to 50%. Rejection rates also alluded to an interesting phenomenon in which some cultures rarely rejected low offers while others frequently rejected fair and even generous offers over 50%. Henrich et al. postulate that each society they studied violated traditional economic models albeit in different ways, thus suggesting that preferences are influenced by sociocultural norms. Namely, the two crucial variables to consider are : 1) payoffs to cooperation- the importance and size of a group's payoff from cooperating in economic production; 2) market integration- the reliance on market exchange within a society on a day-to-day basis.

The researchers rationalize their criteria by explaining that in societies where payoffs to cooperation are low, individuals are less likely to share resources because they do not see it as an

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[101] Roth, A. E., Prasnikar, V., Okuno-Fujiwara, M., & Zamir, S. (1991). Bargaining And Market Behavior in Jerusalem, Ljubljana, Pittsburgh, and Tokyo: An experimental study. *The American Economic Review*, 1068-1095.
[102] Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., Gintis, H., & McElreath, R. (2001). In Search Of Homo Economicus: Behavioral Experiments In 15 Small-scale Societies. *The American Economic Review*, 91(2), 73-78.

advantageous behavior. Market integration, on the other hand, illustrates that a higher frequency of market interactions, such as trades, will instill abstract notions of sharing with other people. A prominent example regarding the power of culture involves the rejection of high offers by tribes in New Guinea. In this group, accepting a gift, even if it is unsolicited, signifies a commitment to do the proposer a favor in the near future. Furthermore, exceptionally large or generous gifts place the receiver in a subordinate position which only exacerbates the social anxiety associated with the choice. Thus, the specific cultural norms in these tribes predicate decision-making and behavior in the ultimatum game. Most importantly, higher degrees of market integration correlated with not only fairer offers, but also a larger number of fair offers. In a sense, more experience with economics and markets led people to offer larger shares of money. This result seems contradictory to the one found in samples of American university students. Experienced economic agents were more likely to act in a self-interested manner, but the inverse effect was found in the cross-cultural study.

Conclusion

When first approaching the question of why economists behaved differently in experimental settings such as the ultimatum game, the learning hypothesis seemed like a plausible and obvious answer. By learning about economic models and their predictions, the students would be more likely to behave in accordance with what they were taught while earning their degree. However, research indicates that economics majors do not act more rationally after four years of an undergraduate education. Rather, data suggest that individuals behaving in a more rational sense self-select into the discipline. This does not demonstrate that all people who are rational-minded end up becoming economics majors. It means, however, that those who do choose economics as a field of study tend to act more rationally.

This phenomenon raises an interesting point concerning the trajectory of economic thought. After Adam Smith, economics started down the path of narrowing its scope. Smith wrote about the whole person in *The Theory of Moral Sentiments* including notions of empathy, compassion, and fairness. Ricardo's Iron Law of Wages was a macabre view of equilibrium in the long term, and he believed that there was no alternative to this solution; people were fated to live in the reality illustrated by the model. The marginalists believed they answered a question of morality with the theory of diminishing marginal utility. Employers and landowners no longer had to worry about the appropriate or just wage for their workers. Instead, they were paid what they were worth, which was measured in terms of production. Wicksell and Marshall further narrowed economics despite working on macroscopic ideas like supply and demand, and gross domestic product. The theory moved ahead and was being constantly refined, but its

representation of reality was already lacking in the early 20th century. Then, with the development of game theory, human behavior was reduced to mathematical equations at great cost. Von Neumann and Morgenstern based their seminal work on the assumption that economic agents are perfectly rational and self-interested.

Perhaps the narrowing of economics can partially be explained by the types of individuals drawn towards the discipline. Since recent experimental data demonstrate that economists perform more rationally in certain tasks, then economics could have become an echo chamber of people self-selecting to a field that made sense to them. The assumption of rationality at the foundation of game theory might be less of a convenient axiom to allow for the theory to work, and more of an actual belief held by the two economists. First of all, the calculations made in the article describing game theory are complicated and intricate even with the broad assumptions about humanity. In addition, von Neumann and Morgenstern were rather eccentric characters whose ideas went beyond the realm of economics. Von Neumann served as an advisor on the US Atomic Energy Commission, playing a large role in the nuclear arms race.

The narrowing could have been more than just a natural tendency for a new discipline to become more refined and theoretical. The economists themselves could have shaped the progress of economics, their inclination to act more rationally being expressed in the models they developed. Their worldview could have been a projection of how they reason and frame decision-making. In other words, in the minds of the economists rationality was not a baseless, overarching assumption but a generally accurate representation of reality. For instance, if they were to play the ultimatum game, they would be more likely to offer a very small split of the

money and accept a low offer as well. Using this perspective, it becomes easier to understand the progress of economics and how it arrived at the conclusions of game theory.

The bold assertions regarding utility maximization and rational behavior attracted the attention of psychologists and critics alike. Research on heuristics demonstrated that information processing is influenced by framing and context effects. People utilize cognitive shortcuts to efficiently make judgments and consider certain cues over others. Instead of paying attention to all relevant information as a perfectly rational agent would do, cognitive processes narrow down the salient features, reducing cognitive load, in order to make a decision. Prospect theory suggests that individuals weight probability when given risky choices. A five percent probability is not precisely five percent in people's minds but rather a subjective perception of five percent which typically corresponds to a higher probability.

The research in this area picked up rapidly after the 1970s. Experimental results showed consistent departures from rationality when observing human behavior. Traditional economic models were unable to account for most people's behavior. Individuals were less self-interested than anticipated and showed a strong concern for others and fairness. Although prospect theory has yet to overtake expected utility theory as the mainstream explanation for choice under risk, economists began developing social preference models. These models incorporate a component of concern for others and social welfare, in addition to personal welfare, in utility functions. However, simply adding a variable to account for prosocial behaviors does not resolve the issue at the core of economics.

Many economists' initial reactions to behavioral economics were that these experiments exploited anomalies in human behavior. They believed that, in general, the majority of

individuals would act rationally and make decisions predicted by economic models. Additionally, they argued that these trivial errors in rationality would disappear on the aggregate when analyzing the entire market. Unfortunately, the violations of self-interest and rationality found in the experimental data indicate a pattern or trend in similar errors. As Ariely notes, the research shows systematic and predictable deviations from economic theory (2010).[103]

Some of the confusion regarding this issue may arise from semantics. Behavioral economics challenges the assumption of rationality in economics and illustrates a refined and realistic picture of human behavior. However, the term "rationality" in this case is defined by economists and has specific implications for the field. Heuristic research and other experiments are not arguing that people are completely irrational. Rather, they do not behave rationally in an economic sense. Despite people not acting fully rationally, it is still possible to model decision-making, investigate choice under risk, and accurately predict behavior. In order for that to happen, economics should take a serious look at psychological data and concepts. Ultimately, economics is studying human behavior in a market setting. Psychology can significantly improve predictions and refine neoclassical economic models. In fact, behavioral economics has not been the only new field to arise from the controversy involving rationality. The list also includes experimental economics, identity economics, and neuroeconomics.

As outlined in the first chapter, economics has undergone a trajectory of narrowing its scope. This led to abstract and theoretical models that did not accurately represent human behavior. Using behavioral economic research as a starting point, progress in economics depends on incorporating ideas and findings from experimental data. Economics has narrowed itself

[103] Ariely, D. (2009). *Predictably Irrational*. New York: HarperCollins.

enough and must now broaden its approach by embracing psychological concepts and attempt to more accurately model human behavior.

References

Allais, M. (1953). La Psychologie De L'homme Rationnel Devant Le Risque: La Theorie Et L'experience. *Journal De La Societe De Statistique De Paris, 94*, 47-73.

Ariely, D. (2009). *Predictably Irrational, Revised And Expanded Edition*. Harper Collins Publishers, London.

Ariely, D. (2010). *Three Questions On Behavioral Economics*. Retrieved from http://danariely.com/2010/07/10/three-questions-on-behavioral-economics/

Ariely, D., & Levav, J. (2000). Sequential Choice In Group Settings: Taking The Road Less Traveled And Less Enjoyed. *Journal of Consumer Research, 27*(3), 279-290.

Ashraf, N., Camerer, C. F., & Loewenstein, G. (2005). Adam Smith, Behavioral Economist. *The Journal of Economic Perspectives, 19*(3), 131-145.

Barberis, N. C. (2013). Thirty Years Of Prospect Theory In Economics: A Review And Assessment. *The Journal of Economic Perspectives, 27*(1), 173-195.

Barberis, N., & Huang, M. (2008). Stocks As Lotteries: The Implications Of Probability Weighting For Security Prices. *The American Economic Review, 98*(5), 2066-2100.

Batson, C. D. (2014). *The Altruism Question: Toward A Social-psychological Answer* Psychology Press.

Boulding, K. E. (1969). Economics as a Moral Science. *The American Economic Review, 59*(1), 1-12.

Camerer, C. (2003). *Behavioral Game Theory: Experiments In Strategic Interaction.* Princeton University Press.

Camerer, C., Babcock, L., Loewenstein, G., & Thaler, R. (1997). Labor Supply Of New York City Cabdrivers: One Day at a Time. *The Quarterly Journal of Economics, 112*(2), 407-441.

Carter, J. R., & Irons, M. D. (1991). Are Economists Different, And If So, Why? *The Journal of Economic Perspectives, 5*(2), 171-177.

Chapman, G. B., & Johnson, E. J. (2002). Incorporating The Irrelevant: Anchors In Judgments Of Belief And Value. *Heuristics and Biases: The Psychology of Intuitive Judgment*, 120-138.

Charness, G., & Rabin, M. (2002). Understanding Social Preferences With Simple Tests. *The Quarterly Journal of Economics*, *117*(3), 817-869.

Clark, J. B. (1902). *The Distribution Of Wealth: A Theory Of Wages, Interest And Profit.* Macmillan.

Crockett, M. J., Kurth-Nelson, Z., Siegel, J. Z., Dayan, P., & Dolan, R. J. (2014). Harm To Others Outweighs Harm To Self In Moral Decision Making. *Proceedings of the National Academy of Sciences, 111*(48), 17320-17325.

De Melo, C. M., Zheng, L., & Gratch, J. (2009). Expression Of Moral Emotions In Cooperating Agents. *International Workshop on Intelligent Virtual Agents,* 301-307.

Fehr, E., Fischbacher, U., & Tougareva, E. (2002). Do High Stakes And Competition Undermine Fairness? Evidence from Russia.

Fehr, E., & Gächter, S. (2000). Cooperation and Punishment in Public Goods Experiments. *American Economic Review*, *90*(4), 980-994.

Fehr, E., & Gachter, S. (2000). Fairness And Retaliation: The Economics Of Reciprocity. *The Journal of Economic Perspectives, 14*(3), 159-181.

Fehr, E., & Schmidt, K. M. (1999). A Theory Of Fairness, Competition, And Cooperation. *The Quarterly Journal of Economics, 114*(3), 817-868.

Forsythe, R., Horowitz, J. L., Savin, N. E., & Sefton, M. (1994). Fairness In Simple Bargaining Experiments. *Games And Economic Behavior*, *6*(3), 347-369.

Frank, R. H., Gilovich, T., & Regan, D. T. (1993). Does Studying Economics Inhibit Cooperation? *The Journal of Economic Perspectives, 7*(2), 159-171.

Gilovich, T., Griffin, D., & Kahneman, D. (2002). *Heuristics And Biases: The Psychology of Intuitive Judgment*. Cambridge University Press.

"Giving Statistics." *Charity Navigator*. Giving USA, n.d. Web. 11 Apr. 2017. Retrieved from https://www.charitynavigator.org/index.cfm/bay/content.view/cpid/42

Gonzalez, R., & Wu, G. (1999). On The Shape Of The Probability Weighting Function. *Cognitive Psychology, 38*(1), 129-166.

Guth, W., Schmittberger, R., & Schwarze, B. (1982). An Experimental Analysis Of Ultimatum Bargaining. *Journal of Economic Behavior & Organization, 3*(4), 367-388.

Harbaugh, W. T., & Krause, K. (2000). Children's Altruism In Public Good And Dictator Experiments. *Economic Inquiry, 38*(1), 95-109.

Heims, S. J., & Bailey, D. W. (1982). John von Neumann and Norbert Wiener, From Mathematics To The Technologies Of Life And Death. *American Journal of Physics, 50*(4), 383.

Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., Gintis, H., & McElreath, R. (2001). In Search Of Homo Economicus: Behavioral Experiments In 15 Small-scale Societies. *The American Economic Review, 91*(2), 73-78.

Jevons, W. S. (1879). *The Theory Of Political Economy.* Macmillan and Company.

Kahneman, D. (2003). Maps Of Bounded Rationality: Psychology For Behavioral Economics. *The American Economic Review, 93*(5), 1449-1475.

Kahneman, D. (2011). *Thinking, Fast And Slow.* Macmillan.

Kahneman, D., Fredrickson, B. L., Schreiber, C. A., & Redelmeier, D. A. (1993). When More Pain Is Preferred To Less: Adding A Better End. *Psychological Science, 4*(6), 401-405.

Kahneman, D., Knetsch, J. L., & Thaler, R. (1986a). Fairness As A Constraint On Profit Seeking: Entitlements In The Market. *The American Economic Review,* , 728-741.

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1986b). Fairness And The Assumptions Of Economics. *Journal of Business,* , S300.

Kim, H., & Markus, H. R. (1999). Deviance Or Uniqueness, Harmony Or Conformity? A Cultural Analysis. *Journal of Personality and Social Psychology, 77*(4), 785.

Krugman, P. (1999). What Economists Can Learn From Evolutionary Theorists - and vice versa., 17-29. Retrieved from http://www.econis.eu/PPNSET?PPN=322019508

Laibson, D. (1997). Golden Eggs And Hyperbolic Discounting. *The Quarterly Journal of Economics, 112*(2), 443-478.

List, J. A. (2003). Does Market Experience Eliminate Market Anomalies? *The Quarterly Journal of Economics, 118*(1), 41-71.

List, J. A. (2004). Neoclassical Theory Versus Prospect Theory: Evidence from the marketplace. *Econometrica, 72*(2), 615-625.

Mankiw, N. G. (2014). *Principles of Macroeconomics.* Cengage Learning.

Marwell, G., & Ames, R. E. (1981). Economists Free Ride, Does Anyone Else?: Experiments On The Provision Of Public Goods, Iv. *Journal Of Public Economics*, 15(3), 295-310.

Marx, K. (2007). *Capital: A Critique Of Political Economy - The Process Of Capitalist Production.* Cosimo.

McClure, S. M., Laibson, D. I., Loewenstein, G., & Cohen, J. D. (2004). Separate Neural Systems Value Immediate And Delayed Monetary Rewards. *Science, 306*(5695), 503-507.

Menger, C. (2007). *Principles of Economics.* Ludwig von Mises Institute.

Mill, J. S. (2009). *Principles of Political Economy*. La Vergne: General Books LLC.

Murnighan, J. K., & Saxon, M. S. (1998). Ultimatum Bargaining By Children And Adults. *Journal of Economic Psychology, 19*(4), 415-445.

Nasar, S. (2011). *A Beautiful Mind.* Simon and Schuster.

Odean, T. (1998). Are Investors Reluctant To Realize Their Losses? *The Journal of Finance, 53*(5), 1775-1798.

Pressman, S. (2013). *Fifty Major Economists.* Routledge.

Ricardo, D. (1811). *The High Price Of Bullion, A Proof Of The Depreciation Of Bank Notes.* John Murray.

Ricardo, D. (1815). *An Essay on the Influence of a Low Price of Corn on the Profits of Stock* (Vol. 4, pp. 1-41). J. Murray.

Ricardo, D. (1891). *Principles Of Political Economy And Taxation.* G. Bell and sons.

Ross, I. S. (2010). *The Life Of Adam Smith.* Oxford University Press.

Roth, A. E., Prasnikar, V., Okuno-Fujiwara, M., & Zamir, S. (1991). Bargaining And Market Behavior In Jerusalem, Ljubljana, Pittsburgh, And Tokyo: An experimental study. *The American Economic Review,* , 1068-1095.

Rubinstein, A. (2012). *Lecture Notes In Microeconomic Theory: The Economic Agent.* Princeton University Press.

Sandoval, E. B., Brandstetter, J., Obaid, M., & Bartneck, C. (2016). Reciprocity In Human-robot Interaction: A quantitative approach through the prisoner's dilemma and the ultimatum game. *International Journal of Social Robotics, 8*(2), 303-317.

Schwarz, N., & Vaughn, L. A. (2002). The Availability Heuristic Revisited: Ease of recall and content of recall as distinct sources of information.

Shafir, E., & Thaler, R. H. (2006). Invest Now, Drink Later, Spend Never: On the mental accounting of delayed consumption. *Journal of Economic Psychology, 27*(5), 694-712.

Shefrin, H., & Statman, M. (1985). The Disposition To Sell Winners Too Early And Ride Losers Too Long: Theory and evidence. *The Journal of Finance, 40*(3), 777-790.

Sherman, S. J., Cialdini, R. B., Schwartzman, D. F., & Reynolds, K. D. (1985). Imagining Can Heighten Or Lower The Perceived Likelihood Of Contracting A Disease: The mediating effect of ease of imagery. *Personality and Social Psychology Bulletin, 11*(1), 118-127.

Simon, H. A. (1955). A Behavioral Model Of Rational Choice. *The Quarterly Journal of Economics, 69*(1), 99-118.

Smith, A. (2005). *Wealth of Nations.* JSTOR.

Smith, A. (2010). *The Theory of Moral Sentiments.* Penguin.

Strathern, P. (2001). *Dr Strangelove's Game: A Brief History Of Economic Genius.* Hamish Hamilton.

Thaler, R. H., & Shefrin, H. M. (1981). An Economic Theory Of Self-control. *Journal of Political Economy, 89*(2), 392-406.

Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology, 5*(2), 207-232.

Tversky, A., & Kahneman, D. (1975). Judgment Under Uncertainty: Heuristics and biases. *Utility, probability, and human decision making* (pp. 141-162). Springer.

Tversky, A., & Kahneman, D. (1983). Extensional Versus Intuitive Reasoning: The conjunction fallacy in probability judgment. *Psychological Review, 90*(4), 293.

Veblen, T. (1904). *The Theory Of Business Enterprise*. Scribner's Sons.

Veblen, T. (2005). *The Theory Of The Leisure Class; An Economic Study Of Institutions.* Aakar Books.

Von Neumann, J., & Morgenstern, O. (2007). *Theory Of Games And Economic Behavior.* Princeton University Press.

Wänke, M., Schwarz, N., & Bless, H. (1995). The Availability Heuristic Revisited: Experienced Ease Of Retrieval In Mundane Frequency Estimates. *Acta Psychologica*, 89(1), 83-90.

Williamson, O. E. (1985). *The Economic Institutions Of Capitalism.* Simon and Schuster.

Wilson, T. D., Houston, C. E., Etling, K. M., & Brekke, N. (1996). A New Look At Anchoring Effects: Basic anchoring and its antecedents. *Journal of Experimental Psychology: General, 125*(4), 387.